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A Monthly Journal of Engineering Progress

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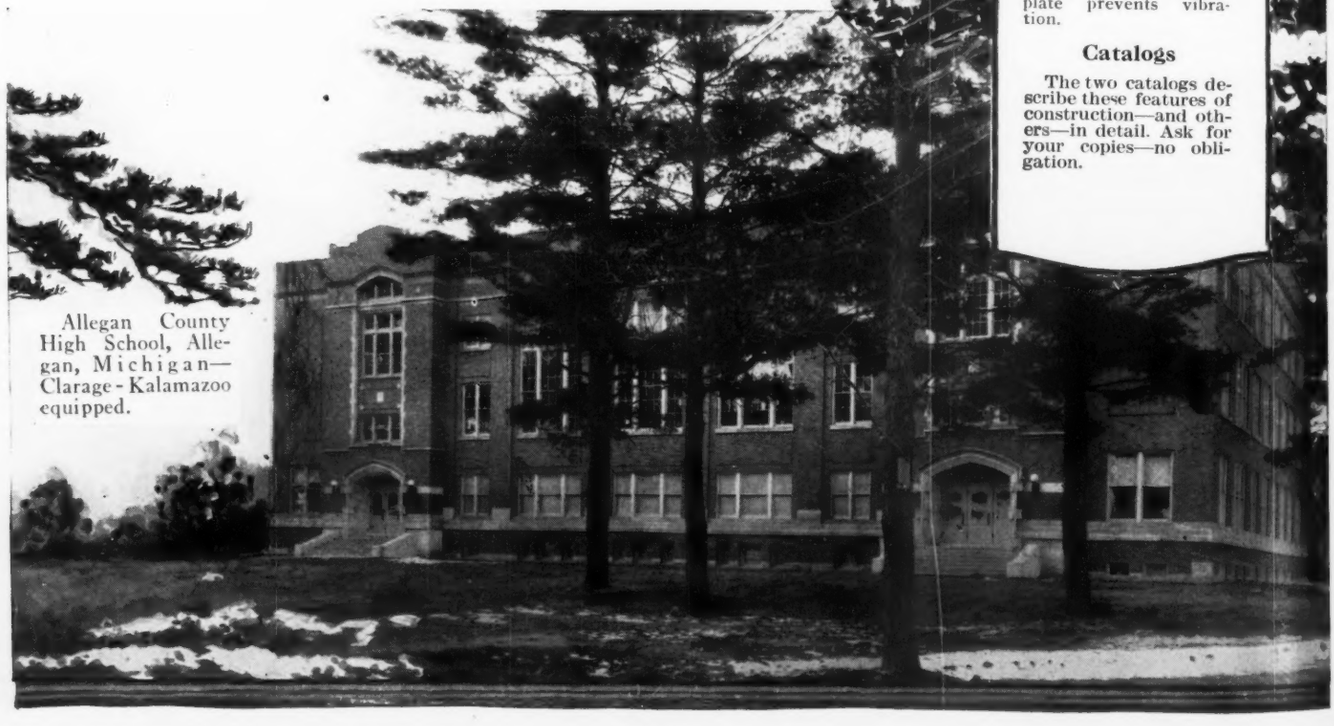

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The Heating and Ventilating Magazine

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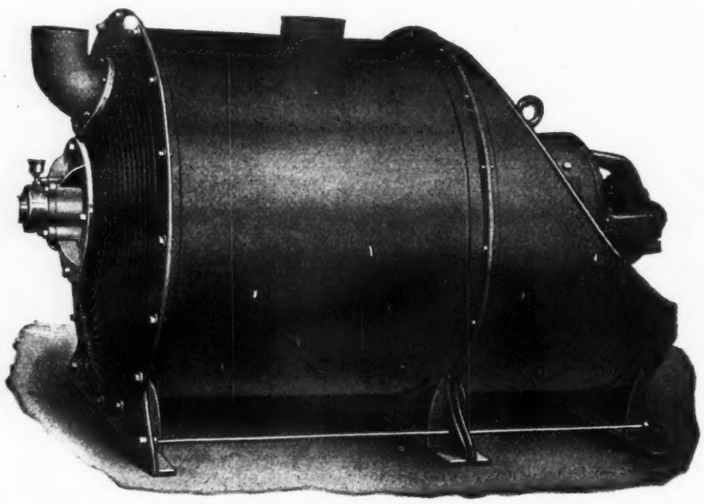

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The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress.

MAY, 1923

The Report of the New York State Commission on Ventilation

From a Summary Prepared by the Commission Expressing Its Conclusions in Favor of Window Ventilation

WHEN the New York State Commission on Ventilation was appointed by Governor Sulzer in 1913, the ventilation of schools, theatres, factories, and office buildings was, as it still is, notoriously bad."

Thus reads the introduction to the voluminous report of the New York State Commission on Ventilation, and the writer, Albert G. Milbank, who represented Mrs. Elizabeth Milbank Anderson in the early negotiations which led to the organization and appointment of the commission and who acted as treasurer of the fund which she established to carry on its work, then adds:

"Experts freely expressed the opinion that hundreds of thousands of dollars were annually wasted in the installation of worthless ventilating devices. They were frank in stating that very little was positively known about the subject of ventilation. It was a dark realm of sanitary science and public hygiene. After a long period of scientific work, necessarily interrupted by the war, the commission has been able to complete its extensive report for publication."

Unlike most State commissions, this commission worked without State appropriation, the entire large cost being borne by the Milbank Memorial Fund, which was established and endorsed by Mrs. Elizabeth Milbank Anderson, who had become greatly interested in the subject of ventilation through her many years of work and co-operation with the New York Association for Improving the Condition of the Poor. "It is believed," states the commission, "that the report will constitute a permanent contribution to science and will result in general improvement of health and hygiene conditions, particularly among the school children of the land."

PERSONNEL OF THE NEW YORK STATE COMMISSION ON VENTILATION.

The following is a list of the membership of the commission and the main affiliations of the personnel at the time of appointment:

Professor Charles Edward Amory Winslow, associate professor of biology, College of the City of New York; Curator of the Department of Public Health, American Museum of Natural History.

Dwight D. Kimball (of the firm of R. D. Kimball and Company, New York City), a practical ventilating engineer.

Dr. Frederick S. Lee, Dalton professor of physiology, College of Physicians and Surgeons, New York City.

Dr. James Alexander Miller, director of the Tuberculosis Clinic, Bellevue Hospital, New York City; professor of clinical medicine, College of Physicians and Surgeons, New York City.

Professor Earl B. Phelps, professor of chemistry, United States Hygienic Laboratory, Washington, D. C.

Professor Edward Lee Thorndike, professor of educational psychology, Teachers College, Columbia University.

General Plant of the Experiments Conducted by the Commission.

OBJECT OF THE EXPERIMENTS.

The physiological researches aimed to secure answers to the four following questions:

1. What is the effect of the overheating, such as obtains in ordinarily occupied rooms, on the bodily processes and on physical and mental efficiency?

2. What is the actual effect on the body of carbon dioxide, and the chemical substances of expired air?

3. What is the effect of exposure to drafts and to low temperatures and, in particular, what is the relation between previous overheating and subsequent exposure to cold, on respiratory, bacterial infections and on catching cold?

4. What is the actual effect of dry air at high and moderate temperatures? Does dry air harm the membranes of the nose,

promote infections and conduce to nervousness?

To answer these questions an extensive series of experiments was conducted. Most of these were carried on in two chambers especially equipped by the commission for the purpose in rooms provided in the College of the City of New York by the college authorities. Two adjacent rooms were used, one known as the Apparatus Room, which contained the equipment for controlling air conditions in a second room, known as the Observation Room. The apparatus installed was adequate to control the temperature, humidity, movement, amount of air supply, and to secure complete records of such physical and chemical conditions of the air as were required.

Fifteen series of experiments were conducted in these rooms, from December 8, 1913, to January 28, 1916. As a rule, a squad of four subjects was used as a working unit. These were under observation for periods of one week to as long as six weeks. Male and female subjects were used, mostly college or high school students. In all, 113 different persons were under observation.

The main experiments involved a study of the effects of air temperature, air humidity and fresh and stale air. The temperatures studied were normal temperature, 68°; moderately high temperature, 75°; and high temperature, 86° F. The humidities studied were medium, 50% saturation, and high, 80% saturation. The normal temperature, 68° F.; is what is pretty generally agreed to be a comfortable, indoor temperature in this climate. The middle temperature studied, 75° F., represented a condition of moderate over-heating. The high temperature of 86° F., especially with high humidity, represented the unpleasant condition of an uncomfortably hot, "muggy" day.

The observations which were made on the subjects by a staff of specialists were extensive in type, as well as in number. The physiological observations included records of changes in body temperature, blood pressure, heart rate, and respiration. In certain special studies, observations were made on the amount of heat produced by the body, the chemical content of respired air, and the air in the lungs, the duration of digestion, and the condition of the blood. An important series of experiments was conducted to determine the effect of air conditions and weight-lifting apparatus.

In addition, studies were made on physical efficiency by means of a stationary bicycle and weight-lifting apparatus.

Psychological observations were similarly made through exhaustive tests measuring memory, judgment, power of attention and certain other performances like typewriting, addition and mental and multiplication.

Besides the observations mentioned above, a special study was made of the effect of various atmospheric conditions on the membrane lining the nose and throat. The purpose of these observations was to determine the effect of exposure to extreme conditions of temperature for long periods of time and the effect of changing from one extreme to another. In these tests a total of 157 persons were observed, among which were students, outdoor workers exposed to cold, indoor workers like firemen and furnace men, and laundry workers, exposed to moist heat.

Still another series of tests was made on animals, to determine the effect of heat and cold on their resistance against infection.

Such is a résumé of the observations made in the laboratory studies. They included, as far as the commission could determine, the most important types of measurements which could be made to determine the effect of various air conditions on health and on mental and physical efficiency.

The Effect of Atmospheric Conditions on Health, Comfort and Efficiency.

Both the physical and the chemical characteristics of air, the report states, affect health and efficiency, but the physical condition of the air, particularly as it relates to its temperature, is the factor of prime importance in practical ventilation.

Harmful effects of overheating have been indicated through measurements of the circulation and body temperature, ability to perform physical work, and through observations on the nasal air passages and susceptibility to disease.

Moderate and high temperatures (75° and 86° F.) especially when combined with high humidities, tend to interfere with the normal function of heat loss which gives rise to discomfort. A burden is thrown on the heat-regulating mechanism, with a resulting increase in body temperature, an increase in the rapidity of the heart rate, an increase in the rate of breathing, and a fall in the general tone of the circulatory system. Besides, overheating considerably depresses the ability to perform physical work. In addition, overheating leads to an abnormal reaction of the membranes of the nose, harming them permanently if long continued. Even after a comparatively short exposure when followed by a chill, it seemingly leads to conditions favorable to bacterial invasion of the air passages. Overheating when followed by a chill also tends to weaken the defensive forces of the body which are brought into play in coping with an invasion of infectious disease organisms, as shown by animal experiments.

The humidity of air, which is another of its physical characteristics, is also of importance in that a high moisture content of the air, especially when the air is warm, mitigates against heat loss through the evaporation of water from the skin. A high humidity will therefore reinforce the harmful action of a high temperature. On the other hand, the report continues, low humidities which have been accredited by many with being responsible for all kinds of mischief, have not been found to interfere with comfort, nor have they been found to induce nervousnes or irritability.

The chemical conditions of air have been found to a secondary effect on the body as compared with the physical conditions. The air of a room without any fresh air supply, containing the odoriferous constituents arising from respiration and from the bodies of the occupants, was found to have no demonstrable effect whatever on comfort, body temperature, rate of the heart, blood pressure, respiration and certain other carefully observed physiological functions. This air contained also large amounts of carbon dioxide. Further, freshness or staleness of air exerted no different effect on mental efficiency, the subjects doing as well in stagnant air as in fresh air.

In but two ways did stale air manifest itself as productive of a real and somewhat immediate effect. As compared with fresh air at the same temperature, vitiated air reduced the performance of physical work. The second and more important effect was on the appetite for food. The appetite was found to be measurably and definitely decreased as a result of breathing stale air. This effect is not to be minimized in view of the probably significant effect on nutrition, which might result from a diminished appetite for food extending over a long period of time.

It is concluded from the experience of other investigations and from the extended researches of the commission that the primary essential for good ventilation is the maintenance of a proper air temperature, of 68° F. or below, but without the production of chilling drafts. At the same time, there should be an air change sufficient to avoid the accumulation of odoriferous or other substances arising from human occupancy. While the bad effects of stale air in the commission's experiments were obtained under somewhat extreme conditions, (with a concomitant carbon dioxide content of from five to fifteen times that of fresh air), vitiated air cannot be declared free from any harmful effect.

The results as interpreted by the commission, indicate that in practical ventilation a good air supply and a room temperature of 68° F. are desirable. A bounteous air supply in the face of high temperature and overheated air is of less importance and likely to produce more harm than a moderate air temperature of 68° with a less lavish air change.

General Plan and Scope of the Field Investigations.

The purpose of the field investigations of the commission was primarily to study certain specific promising and practicable methods of schoolroom ventilation. These investigations included a study of the physical conditions of the air under various methods of ventilation, and subjective results were secured through records of sensations of comfort and mental and physiological reactions of the occupants.

Of the various methods of ventilating schoolrooms, the following special types were studied, since they were either in actual use, or seemed practicable and promising:

Method 1: Room ventilated entirely through the use of windows.

Method 2: Rooms ventilated through the use of windows, supplemented by the use of a simple air duct or vent in the room. In this type of "exhaust" no fan is used for the withdrawal of room air.

Method 3: Rooms ventilated by means of fans pumping air into the rooms supplemented by a simple air duct in the room through which air might find its own way out, known as "plenum supply, gravity exhaust" system.

Method 4: Rooms ventilated by means of fans pumping air into the rooms, with the air of the rooms being mechanically exhausted through special ducts, also by means of fans, known as "plenum and exhaust fan" system.

Method 5: The above *Method 4*, modified so that the same air was supplied to the room over and over again, after being re-conditioned before it was re-circulated.

Early results indicated that window ventilation alone, and the re-circulation method (Numbers 1 and 5 above) were generally inadequate or impracticable.

The main studies centered around window ventilation and fan ventilation, both with gravity or natural exhaust.

The following is a summary of the individual field investigations of the commission:

1. Preliminary experiments in six schools in Springfield and West Springfield, Mass. Fan and window ventilation methods were contrasted. Three months' work, 1915.
2. Experiments on five types of schoolroom ventilation in five different school buildings. Typical fan and window ventilation methods were contrasted. October, 1915, to April, 1916.
3. Studies in a typical schoolbuilding (Public School 51, Bronx, New York City), in twenty classrooms. The conditions in eleven fan-ventilated rooms were compared with those in nine rooms ventilated by means of windows with the use of special types of air deflectors ("window ventilators"). Winter of 1915-16.
4. Studies in three separate schoolbuildings in New York City in which window ventilation in three or four rooms was contrasted with fan ventilation in a similar number of rooms in the same building. November, 1916, to March, 1917.
5. A special study in Wadleigh High School, New York City, of the comfort and general sensations of the air in two window-ventilated rooms and four fan-ventilated rooms. Squads of 24 high school girls, led into the rooms blindfolded, recorded systematically and under supervision their sensations. The purpose of this experiment was to rule out the psychological effect on comfort which a person might experience in a room simply on seeing the windows open or closed, or in knowing that the room was artificially ventilated. Autumn, 1916, and Winter, 1917.
6. An extended research (in co-operation with Dr. S. Josephine Baker, Bureau of Child Hygiene, Department of Health, New York City) on the effect of certain air conditions on respiratory disease among school children. Two separate studies were made, involving 5,533 children. The first study was in 58 rooms of eight schools, the second study in 76 rooms of twelve schools. Observations on sickness and absence were made by nurses and physicians. Window ventilation was compared with fan ventilation. February to April, 1916, and November, 1916, to January, 1917.
7. Studies of air distribution and air currents in a specially constructed schoolroom. Upward and downward ventilation and various combinations of air inlets and outlets were compared. Summer and fall of 1915.
8. An investigation of the value of humidification of schoolroom air, a condition of 28% saturation being contrasted with one of 42%. Two sets of children of similar make-up were observed in especially-

equipped rooms, in School 51. Winter, 1916-17.

9. An investigation of the practicability of re-circulated air in: (a) the gymnasium at the Y. M. C. A. College, Springfield, Mass.; (b) in especially equipped schoolrooms in Minneapolis; and (c) in especially controlled rooms at School 51. These last experiments were conducted from February to June, 1915, and from October, 1915, to April, 1916.

The Results of Various Methods of Schoolroom Ventilation.

The critical studies of the commission bearing on a large number of practical ventilation problems, were conducted in 216 classrooms of 31 different schools over a period of five school semesters or about two and a half years. From these extensive researches certain important conclusions were obtained. The conclusions in all cases were based on a thorough and exhaustive analysis of the air conditions studied and on a determination of their effects on comfort, physical health and mental efficiency.

The most important general finding was that "a well-designed but yet simple arrangement of *window ventilation appeared to be the most promising method for classroom ventilation.*" While well-devised and well-controlled system of fan or artificial ventilation with windows closed were found capable of producing excellent results, it was found that "rooms ventilated by fans have certain characteristics, inherent in this method of ventilation, which make them definitely inferior to rooms ventilated by a good system of window ventilation."

Window-ventilated rooms have less air change and less air motion, particularly in the zone of occupancy, than fan-ventilated rooms. But this lesser air flushing *"has not been found objectionable."* It has, in fact, "been found sufficient to suppress the accumulation of odors." Moreover, this lessened aeration and air flow in window rooms permit the maintenance of a *cooler air condition, "for which cooler condition a very general preference was found* to exist." Furthermore, in window ventilated rooms, the uniformity of air currents and air temperature does not exist as it does in fan rooms. "It is this very uniformity of air conditions, characteristic of fan ventilated rooms, which seems to exert an actually observed *harmful effect on health, through promoting susceptibility to disease and affections of the air passages.*"

Specific practical details of operation of the more general methods of schoolroom ventilation are commented on in the report. The system of window ventilation which was found to be best of all has the following specifications:

THE COMMISSION'S SPECIFICATIONS FOR A WINDOW-VENTILATING SYSTEM.

There must be ample *heat supply through radiators* placed next to the windows. The heat supply in these radiators must be carefully controlled either by hand or by thermostat. *Window boards or deflectors* should be used to impart an upward direction to the incoming air. Panes of glass, 1 ft. high, set in the window sash or a deflector made of parallel curved vanes, should be used. There must be *openings in the inside wall* of the classroom, having at least 8 sq. ft. in diameter in all, leading into air ducts, through which the heated air of the room can naturally find its way out. This is the *"gravity exhaust duct,"* which must be provided for successful window ventilation. "There is no need," states the report, "of a suction fan in this duct, which works against the success of the system." The ducts should have aspirating cowls on the roof, and should be provided with dampers to control down-drafts. Without these gravity exhaust ducts, window ventilation is successful only in mild weather, when inside doors and transoms are usually also freely opened.

The room *must not be overcrowded* for overpopulation mitigates against the success of window-ventilation. In the average-sized classroom, there should be no more than 39 second-grade children or 30 sixth-grade children. There should be a *thermometer* in the room so that overheating can be avoided. A temperature around 67° F. is most agreeable. *Window shades should be so attached* as to avoid flapping.

THE COMMISSION'S SPECIFICATION FOR A FAN-VENTILATING SYSTEM.

The specifications for a successful system of fan ventilation call for not only adequate provision of fan, motor, duct and register equipment, but also *require the temperature and volume of the air supply in each room to be mechanically and individually controlled. Gravity exhaust* ducts should be supplied, as in window ventilation. The incoming air should have a moderately low temperature and there should be radiators in the room to provide heat. The best arrangement of inlet and outlet is one in which the inlet is placed on an end wall 8 ft. above the floor level, with the outlet on the same wall near the floor. The exhaust duct should be ample in size, should have a damper to control back drafts and should have an aspirating cowl at its opening on the roof. A thermometer in the room on the teacher's desk should be plainly marked at 70°, above which the temperature should not be permitted to go.

"The practice of re-circulation of schoolroom air, and of humidification of the air supply to rooms, as adjuncts to systems of fan ventilation, have not yielded good results in the hands of the commission, and are not recommended."

The commission points out that the nature and environment of the enclosure to be ventilated dictate the method of ventilation to be used, and that what is adequate for one type of building may be inadequate for another. Theatres and auditoria, for example, must generally rely on fan systems. Window ventilation would prove inadequate for a school which is overcrowded and in a noisy and unsanitary district.

The report states, finally, that the *avoidance of overheating is the primary essential* of all systems of ventilation and that the most important article of ventilation equipment is the thermometer.

Electrical Heating of Industrial Plants

The Governing Factors Which Determine the Availability of This Method, with Details of a Recent Installation

By J. L. McK. Yardley

GENERAL ENGINEER, WESTINGHOUSE ELECTRIC AND MFG. COMPANY.

THE cleanliness and convenience of electricity have attracted many to investigate and consider the possibility of employing it as a heating medium in dwellings, hotels, public and office buildings. Interest aroused by attractive features has been prevented from developing into enthusiasm merely by the tempering influence of economical considerations. While analyses of the cost of generating the heat unit by the different methods have generally shown electricity greatly outdistanced in competition with fuel for heating, here and there some local condition or expectation not necessarily altogether tangible has sufficiently reduced the handicap to cause a successful electrical installation. In fact, it is surprising, the extent to which the total of electric heating equipment installed in this country has grown in recent years.

The local favorable condition may be a climatic one in which electric heat is justified for brief irregular periods of the year. Even at considerably greater heat unit cost. The condition may be a fortuitous combination of circumstances in which the electricity is really cheap enough due to the low construction and operating costs of the hydro-electric plant, that as "white" fuel it is competitive on a B. T. U. basis with other fuels and in which the months of excess water coincide with the months of low temperature. Unfortunately, high water and low temperature do not coincide on all water sheds, but where they do, the situation is most favorable to the installation of electric heating equipment. Electric heating is the most favorable load in such situations to a fuller development of the water resources beyond the limits of practicable storage, particularly in view of the difficulty of obtaining industrial power or electrolytic load which may be similarly seasonable and yet profitable. For one good reason or another, therefore, the total electric heating load in this country has grown to a considerable magnitude. While this load principally consists of a multitude of small units located in dwellings, there have been a number of larger installations in office buildings, etc., and recently several installations in the factory or shop buildings of industrial plants.

THE INSTALLATION AT BILTMORE HOUSE.

One of the earliest electric heating plants which is generally familiar was installed at Biltmore House, North Carolina, in 1906. In that region the months of high water do not coincide with those of low temperature but a rate of approximately 0.85 cents per K. W. H. was obtainable at that time under certain imposed conditions as to peak, load factor, etc. An uncertain supply of anthracite coal cost $11.00 per ton. Savings in the expense of attendants during irregular periods of opera-

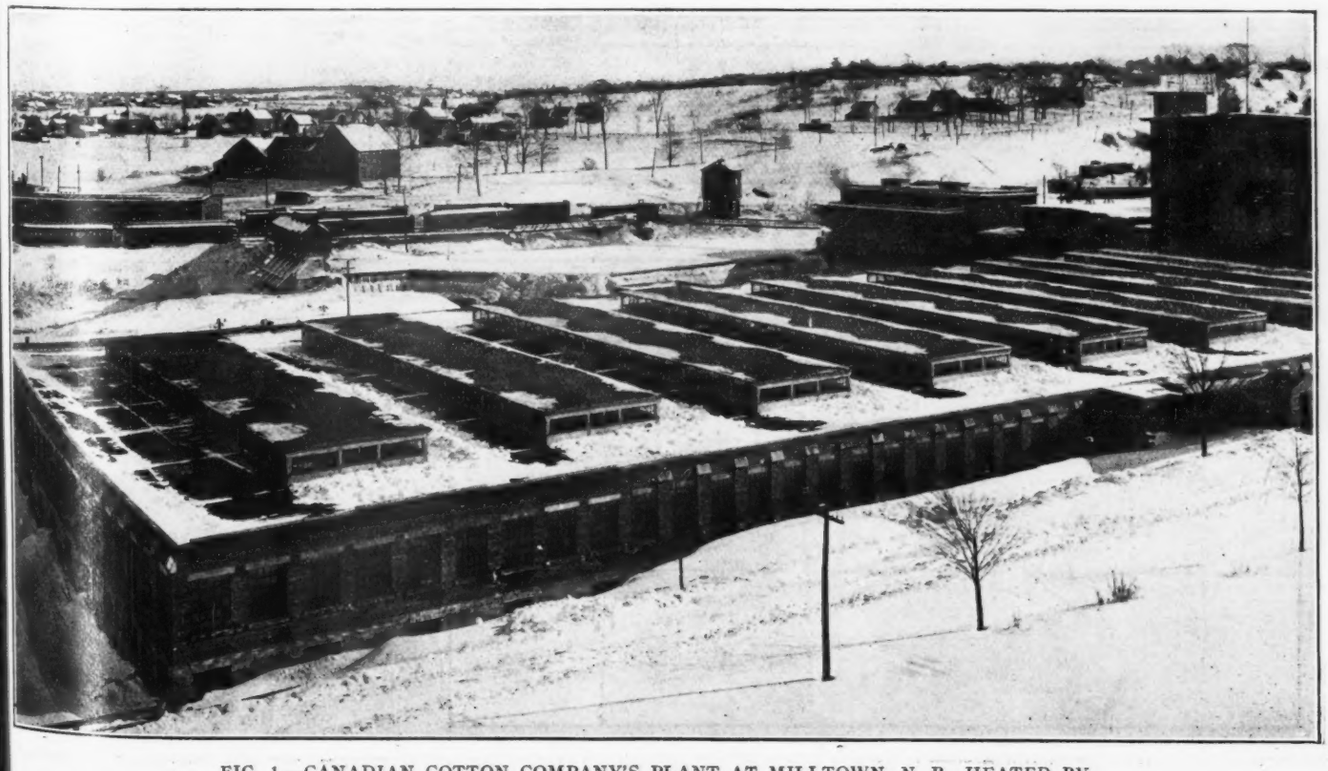


FIG. 1.—CANADIAN COTTON COMPANY'S PLANT AT MILLTOWN, N. B., HEATED BY ELECTRICITY.

tion and general convenience were the principal items which indicated economy for the electric heating plant.

THE OFFICE BUILDING OF THE ONTARIO POWER COMPANY.

Another very early electric heating installation was in the office building of the Ontario Power Company, of Niagara Falls, Ontario, Canada. (See The HEATING AND VENTILATING MAGAZINE for June 1915). This is a three story brick building with basement. There are two floors of offices and one of drafting rooms. There is a large central hall, space containing elevator shaft and stairway. The building is exposed on three sides and contains a total of 72,000 cu. ft. of air space. The architects had planned that the building would be heated by means of a low-pressure steam heating system, having an auxiliary warm air system with forced draft, the idea being to maintain a pressure in all of the outside rooms sufficient to prevent cold air coming in through the cracks in window frames, etc. The air in this auxiliary system was to have been heated by a steam coil in the discharge of the circulating fan. Steam was to have been produced by natural gas which cost somewhat less than 25 cents per 1000 cu. ft.

Due to a very low planned hydro-electric construction cost of about $65.00 per KW. installed, and very low operating cost, the total cost of electric power was to be somewhat less than 0.1 cent per K. W. H. Somewhat later, power was sold in a large block to the Ontario Hydro-Electric Commission at $9.00 per KW. year on peak basis.

Just at that time, however, power was a drug on the Canadian side of Niagara Falls. From the fall of 1905 until July, 1906, when the 60,000 volt transmission line to Syracuse was placed in service, three 7500 KW. generators were operating on a total load in Lockport, N. Y., of from 200 to 300 KW. For several years there was more power available than sold. By the time electric power became scarce there was also a shortage in natural gas and the price of fuel had risen appreciably.

For years, therefore, the 85 KW. electric heater which I built and installed at a cost of $388 in place of the steam coils in the warm air system absolutely saved a fuel bill and considerable expense for attendants. It was found that the low-pressure steam system was entirely unnecessary, a comfortable temperature in the office building being maintained in the coldest weather by the electrically heated air. The heater was divided into a number of sections so that more or less could be switched upon the 220-volt circuit, depending upon the weather. Each section consisted of a double-angle frame, about 3-½ ft. square, carrying ordinary porcelain knobs over which the resistor, heavy galvanized iron wire, wound in spiral by means of a lathe, was strung.

GROWTH OF ELECTRIC HEATING IN TACOMA.

One of the largest scale applications of electricity to house heating in America is in Tacoma, Wash., where there are said to be at least fifty homes having central electric heating furnaces. This has come about through a favorable hydro-electric situation. The months of high water, that is from October to April, coincide with those

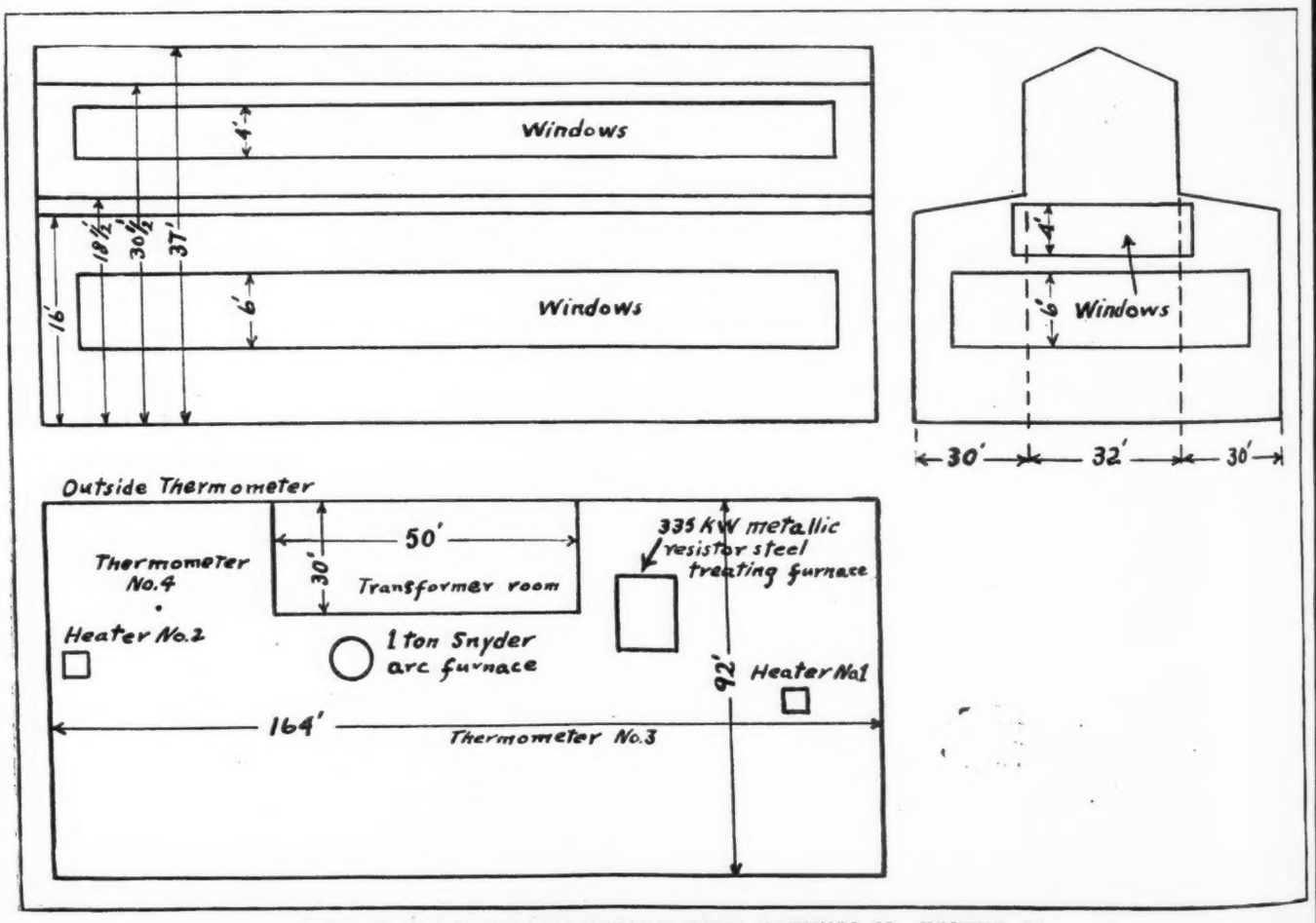


FIG. 2.—FOUNDRY OF THE KEOKUK STEEL CASTINGS CO., KEOKUK, IA.

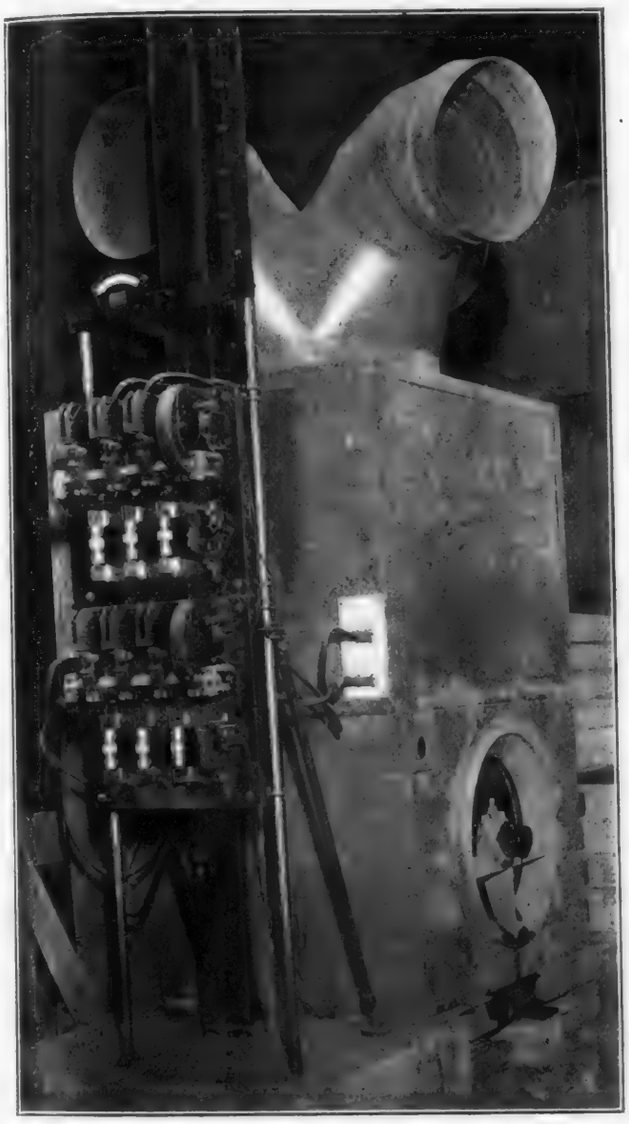


FIG. 3.—TYPE OF ELECTRIC WARM-AIR HEATER USED IN KEOKUK FOUNDRY BUILDING.

of lowest temperature. A 20,000-KW. hydro-electric station with transmission lines and situation was built at a cost of only $112 per rated KW. The result was a rate for heating load of approximately 0.6 cents per K. W. H. This rate proved so low under the climatic conditions that, owing to its cleanliness and general convenience, heating by electricity became increasingly popular. Seattle claims more homes heated by electricity than any other city, nearly 2000 being so heated during 1922, owing to a power rate for heating of only slightly over 0.1 cents per K. W. H.

CONDITIONS OF SUCCESS IN INDUSTRIAL PLANTS.

The success of electric heating in industrial plants must depend considerably more upon economic conditions which will bear strict analysis than in domestic heating. Cleanliness and convenience are not sufficient in themselves but must produce some tangible benefit or there must be other economic advantages. This being so, it is indeed noteworthy that we are finding industrial plants employing electricity for heating factory and shop buildings.

The Canadian Cottons Company at Milltown, New Brunswick, is an instance, in which electricity is being employed in the heating of a large factory building. There is a peculiar local situation in which a large motor load, normally operating during a nine-hour day only, causes an excess of hydro-electric power to be available for heating at practically no cost, particularly when most needed during the night hour, noon hours and week ends.

Here again it was a case of supplanting steam coils in a warm air system in which the air was piped to various parts of the weave shed and distributed by means of various outlets from the main pipes as in the usual factory warm air heating system. This 2000 KW. installation of oven-type heating elements has gone through two winters satisfactorily, the coldest night conditions having demonstrated 1600 KW. of it to be sufficient.

The foundry of the Keokuk Steel Castings Company, Keokuk, Iowa, is heated by electricity in a somewhat different and novel manner. The foundry building is located on the bank of the Mississippi and is exposed to all the winds.

The building has a steel frame, covered with stucco on expanded metal. The walls are from ¾ in. to 1 in. thick. The principal dimensions of the building are shown in the accompanying sketch (Fig. 2). Hydro-electric power is obtained at a rate of approximately 0.4 cents per K. W. H.. The foundry is operated only for

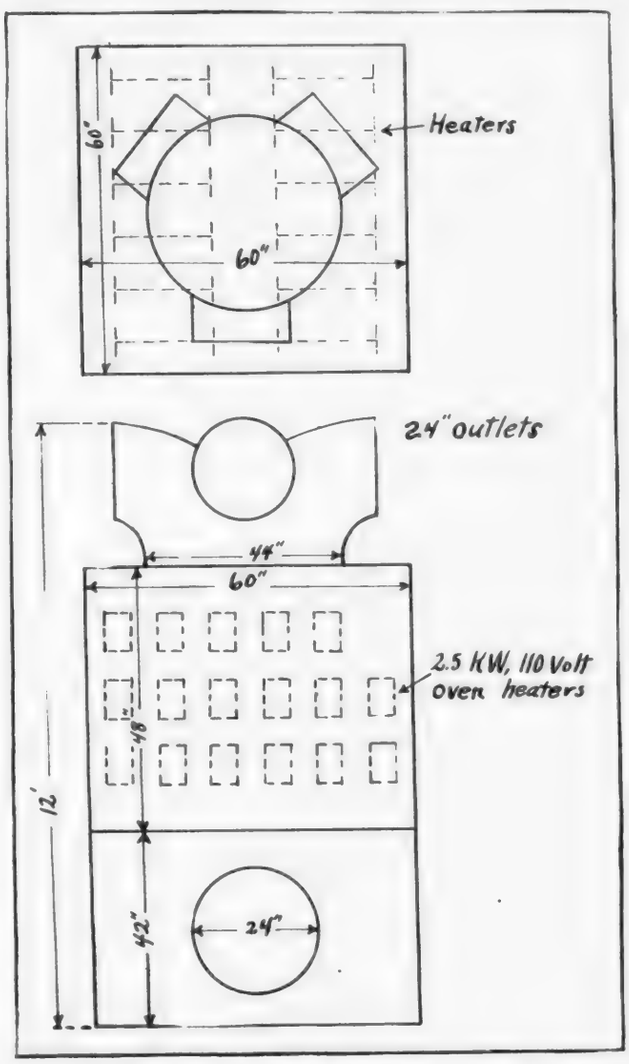


FIG. 4.—ARRANGEMENT OF ELECTRIC HEATING ELEMENTS IN HEATER CASING.

a nine-hour day. The purpose of the electric heating system is to maintain the temperature of the building at night so that there will be comfortable working conditions when the men arrive in the morning. During the day there is sufficient heat from the electric melting furnace and from the electric annealing furnace, shown on the sketch, to keep the building comfortable. The electric annealing furnace works on a 24-hour cycle, but gives off more heat during the day owing to the fact that it is open at that time and its work is being cooled and removed.

Fig. 3 shows a view of the heater casing, together with inlet and discharge vents and control panel. By means of a series relay through which the current to the motor passes, the power will be cut off the heater whenever the motor stops. The more usual practice in oven control is to place in the casing a bi-metallic thermostat set some safe element temperature and to operate upon the contactor in the oven circuit. Two of those heating units are used, one at each end of the building, as shown on the sketch.

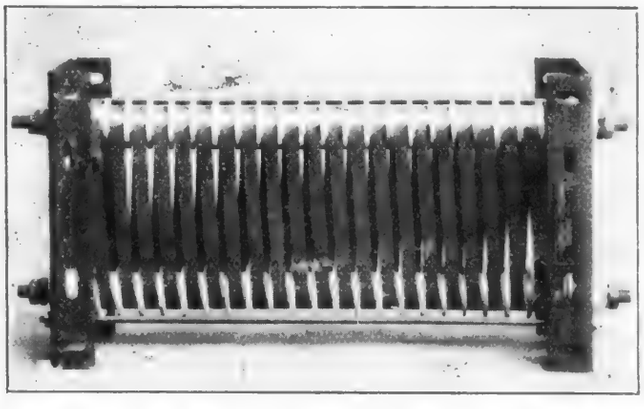


FIG. 5.—OVEN-TYPE ELECTRIC HEATER USED IN FAN BLAST UNIT.

The general dimensions and arrangement of heating elements in the casing are shown (Fig. 4). The casing has two sections, the lower for the fan and the upper for the heater. There is a 24-in. fan in the lower section driven by motor. The fan runs at 400 RPM. and circulates approximately 15,000 cu. ft. of air per minute. On top of the casing are the outlet pipes. The main pipe is 44-in. in diameter and it branches into three 24-in. pipes set at an angle of 120° to each other. In the upper section of each casing there are 23 2.5 KW. 110-volt oven-type heaters of type shown in Fig. 5. The heaters are mounted in three horizontal layers with the ribbon vertical. The lower layer has twelve heaters mounted in two rows; so has the middle layer. The top layer has only ten heaters, although two more could be added if desired. Ten of the heaters in the lower layer are connected to the 220-volt supply, thus obtaining approximately 10 KW. from each heater. The remainder of the heaters are connected two in series on 220 volts with an output of 2-½ KW. each. The total capacity of each casing is, therefore 160 KW. The heaters run black except for a few red spots on the lower layer which the air does not directly strike.

The following data was taken during one night on this 320 KW. electric heating system.

Time 2/6/23	Heater Capacity KW.	Outside Temp. Deg. F. No. 1	Inside Temperature Deg. F. No. 1 Panel	No. 2 Panel	No. 3	No. 4
8:30 P. M.	320	22	70	72	60	58
9:00		22	70	72	60	58
10:00		20	66	70	58	56
11:30		20	66	69	57	54
1:00 A. M.		19	64	67	56	53
2:30 A. M.		19	64	66	56	52
4:30 A. M.		18	62	64	53	50

The thermometers located at the control panels were approximately 8 ft. from the ground and were within 2 ft. of the heater casing. Thermometers No. 3 and 4 were approximately 4 ft. from the floor and located in the foundry relatively as shown in the sketch. At the time the above data was taken the heating system could not quite maintain a 40° F. difference between the outside and the inside. The air outlets are about 12 ft. above the ground. The warm air was forced out in a horizontal plane at about this level. The building near the roof, as for instance, the crane cab, is warmer than near the floor. This indicates that to more nearly equalize temperature the air should be directed to a greater extent towards the floor. Did increased expense warrant, better results would of course be obtained if the warm air were piped to various parts of the building and distributed.

In many shops an inexpensive installation is desired. Often the distributing piping of the ordinary warm air system is inadmissible, owing to interference with the operation of the crane or other material handling machinery. For such industrial plants similarly enjoying low-priced power, the description of the electric heating equipment of the Keokuk Steel Castings Company may be suggestive.

Relative Efficiency of Water-Resistant Coatings for Wood

	Percentage Efficiency
Aluminum-leaf process-asphalt paint base	98
Three coats spar varnish coated with vaseline	98
Three coats of asphalt paint	96
Aluminum-leaf process-spar varnish base	95
Aluminum-leaf process-cellulose lacquer base	94
Aluminum-leaf process-oil paint base	93
Three coats of aluminum bronze (quick drying)	92
A heavy coating of paraffine	91
Three coats of rubbing varnish	89
Three coats of enamel	88
Three coats of orange shellac	87
Three coats of cellulose lacquer	73
Sheet pyralin 0.005 in. thick glued to wood	68
Three coats of graphite paint	61
Three coats of spar varnish	60
Three coats of whitelead oil	54
Five coats of linseed oil applied hot and two coats of wax	38
No coating	0

—*United States Forest Service.*

Aerology for Amateurs and Others

The Evolution of Modern Ventilation and its Effect on Present aud Future Practice

By E. Vernon Hill

V—Air Dust

IN reading the previous articles on Aerology, one is liable to gain the impression that the only thing of importance in the ventilation of a room is the wet-bulb temperature and its relations to air motion. In fact, the conclusions of Leonard Hill, previously quoted, tend to give credence to this belief.

While it is true that the factors of temperature, humidity and air motion are, perhaps, of major importance in determining physical comfort, nevertheless, we must not lose sight of other factors that have an ever important bearing on air conditions where people are subjected to them over a considerable period of time. The first of these factors is air dust.

Dust has always been recognized as an important factor in air conditions. This point need not be argued as the mortality record of workmen engaged in dusty trades is ample evidence of its effects on the human organism. This subject was brought frocefully to the attention of the sanitarians as far back as the beginning of the seventeenth century, when Ramazini described the then recognized dusty trades and the harmful effects on the workmen continuously employed therein. Konrad Meier, some years ago, brought this matter to the attention of the profession in a somewhat different light. While everyone recognized the harmful effects of certain kinds of dust in such trades as stone-cutting, wool-sorting, tanning, etc., fine dust as it occurs in school class rooms, assembly halls, offices, etc., has not been given the same careful attention.

EFFECT OF HEAT ON DUST.

Meier contends that even the small amount of dust found in occupied rooms is decomposed, or altered chemically when brought into contact with radiators or blast coils and ammonia compounds broken up and liberated that are distinctly unpleasant and even harmful.

While it is not clear that this contention has been experimentally proven, still it is undoubtedly true that many instances occur when this factor is of considerable importance in determining air conditions in a room. Odors are in this way produced which, although possibly not strong enough to be clearly recognized as such, are still sufficient in amount to cause a distinctly unpleasant sensation of closeness, or discomfort.

DUST AS A CARRIER OF MICROBE-ORGANISMS.

In addition to these factors, dust as a carrier of microbe-organisms is of enormous importance. Air-borne infections were considered at one time as the principal cause of the majority of deaths due to preventable diseases. The view of the medical profession, however, has changed recently with regard to this situation and the tendency at the present time is to minimize the importance of air-borne infection and to magnify, perhaps, the importance of infections from contact.

Recent contributions, by Durham and Miller on "Mechanics of Respiratory Infection" give us a clearer conception of the importance of dust in these morbid conditions and also increase the probability that several diseases, such as measles, mumps and scarlet fever can be added to pneumonia and tuberculosis as being largely air-borne, or what amounts to the same thing, dust-borne.

A statement recently made by Dr. W. A. Evans to the effect that 50% of the preventable diseases gain entrance to the body through the respiratory tract is stating the situation mildly and while some of these infections may be from moisture droplets from the mouth and nose, still the great majority are caused by dust particles of some kind gaining entrance to the tract with their ever-present infecting organisms.

DUST AS AN IRRITANT.

Another phase of this subject that would bear investigation is the effect of constant inhalation of even small amounts of air dust upon certain connective tissue structures in the human body. The assumption is not out of place that the constant passage through and the elimination from the body of these particles may be an important factor through mechanical irritation or otherwise in the early production of an excess of connective tissue in the circulatory and excretory systems. In other words, we say that it is a possibility, if not a probability, that arterio-sclerosis, or premature old age, may result from the constant inhalation and excretion of air dust.

HOW WORKMEN ARE AFFECTED BY DUST.

Dust affects workmen subjected to it in three ways, depending upon the manner or method of contact, or ingress into the body; first, by contact with the skin, or exposed mucous surfaces producing the so-called dermatoconioses. These skin lesions are well known to the specialist. The dermatitis of the skin on the necks of the workmen who carry cement, or similar substances that give off an irritating dust; irritation of the eyes and eyelids of workers in the borax mills and some of the trade eczemas are typical examples of these conditions.

The second class of cases are caused by ingestion of dust through the nose and mouth. These are called enteroconioces. Oliver states, "The enteroconioces or gastro-intestinal lesions induced by dust are less well defined bacteriological entities than the infections of the skin or lungs and yet they play an important part in poisoning by such metallic dusts as lead, arsenic and mercury." Apart from such symptoms as vomiting,

diarrhoea and colic, which these cause, there are well marked physical signs of poisoning present as, for example, the "blue line" on the gums in lead poisoning and the loose teeth and ulcerated gums in mercurial poisoning.

DUST INGESTION A CAUSE OF DISEASE.

Certain well-defined diseases and symptoms are caused from poisons gaining entrance to the intestinal canal through dust taken into the mouth, on the food, in the water, from the air, etc. It is perfectly obvious, however, that there are a large number of cases of ill health and lowered efficiency that are not well defined, or recognized as being due to dust ingestion, especially where the quantity or character of the dust does not have a specific toxic effect. I refer to industries where the dust in the air is not heavy, or particularly poisonous, but where its ingestion occurs continuously over long periods of time, our information on cases of this kind is meagre indeed.

EFFECT OF INHALED DUST.

The third class of disease caused by air dust is the so-called pneumonoconiosis, due to the inhalation of the particles. This class has received considerable study in the past, particularly from the pathological and symptomatic standpoint. Chalicosis, due to stone dust; Siderosis, due to metallic dust; Anthracosis, due to coal dust; Byssinosis, due to the inhalation of cotton fibres, etc., are well recognized and thoroughly treated in the literature. We must confess, however, that while the pathological lesions and the symptomatology of these diseases have been very completely studied and described, and while their treatment is fairly well understood, still it is apparent that the progress made along preventative lines has been so slow as to be almost imperceptible. The excellent work in recent years by Dr. Alice Hamilton and others has materially improved conditions, but very little has been done toward establishing necessary standards of air dustiness. We have some State laws requiring dust-removing appliances and these laws are enforced as well as can be expected under the circumstances. The difficulty has been to determine what extent air dustiness prevailed in a given factory, either with or without dust-removng appliances.

In other words, no standards of air cleanliness with respect to dust have been established. It is not sufficient to say that air is heavily laden with dust, is moderately dusty, or is comparatively free from dust. These terms have little meaning. In order to attack the problem efficiently and succesfully, we must have a definite standard of air cleanliness and accurate means for determining when this standard is maintained. It is due to our lack of standards that so little progress has been made in this important branch of health conservation.

POINTS TO CONSIDER IN CLASSIFYING DUST.

In approaching the problem from this viewpoint, it is necessary to have a workable classification of air dust, based on the following characteristics:

1. *Character of the dust.* This is essential in determining its effect on workmen and the extent of dustiness permissible consistent with their health.

2. *Effect of the various kinds of air dust on the human organism.* This is to a certain extent an amplification of the first question, bearing, however, a somewhat different aspect in that the physiological effects are given prominence, rather than the chemical or physical.

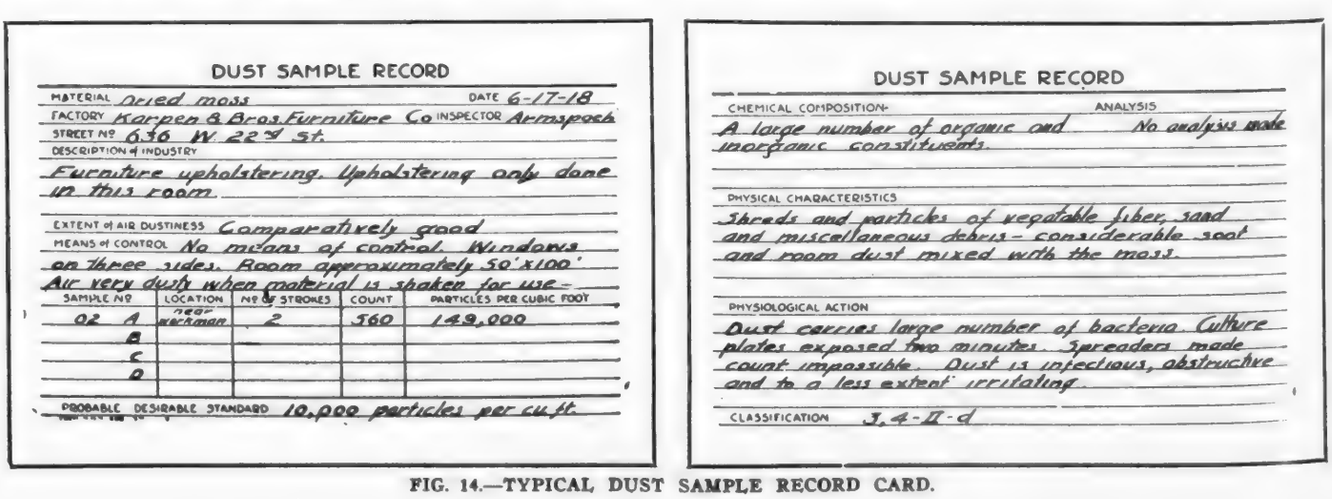
3. *Occurrence of the various kinds of dust* determined in an intelligible manner. Instead of saying that the air is dusty, or comparatively free from dust, etc., we must say that in the industries examined we found under poor conditions of operation, perhaps 50,000 dust particles per cubic feet, where modern preventive appliances were used, perhaps 5,000 particles.

4. *Establishment of a fair maximum standard* for the various occupations and industries, a standard that is practical and can be maintained with a reasonable initial outlay for apparatus and a reasonable upkeep for the same. In arriving at this standard, we must proceed from the assumption that relatively dust-free air is a natural and desirable medium which human beings should require and we must attempt to set our standards as close to the ideal as practical considerations will allow, having clearly in mind in each instance the effect of the different kinds of dust on the human body.

CLASSIFICATION OF DUST.

For convenience in study, dust is classified as follows:

(A)	1.	Poisonous	3.	Infectious
	2.	Irritating	4.	Obstructive
(B)	1.	Animal	III.	Mineral
	II.	Vegetable	IV.	Metallic



DUST SAMPLE RECORD

MATERIAL Dried moss DATE 6-17-18
FACTORY Karpen & Bros. Furniture Co INSPECTOR Armspach
STREET Nº 636 W. 22nd St.
DESCRIPTION of INDUSTRY
Furniture upholstering. Upholstering only done in this room.
EXTENT of AIR DUSTINESS Comparatively good
MEANS of CONTROL No means of control. Windows on three sides. Room approximately 50'x100'. Air very dusty when material is shaken for use.

SAMPLE Nº	LOCATION	Nº of STROKES	COUNT	PARTICLES PER CUBIC FOOT
02 A	1000 workman	2	560	149,000
B				
C				
D				

PROBABLE DESIRABLE STANDARD 10,000 particles per cu ft.

DUST SAMPLE RECORD

CHEMICAL COMPOSITION — ANALYSIS
A large number of organic and inorganic constituents. — No analysis made

PHYSICAL CHARACTERISTICS
Shreds and particles of vegetable fiber, sand and miscellaneous debris - considerable soot and room dust mixed with the moss.

PHYSIOLOGICAL ACTION
Dust carries large number of bacteria. Culture plates exposed two minutes. Spreaders made count impossible. Dust is infectious, obstructive and to a less extent irritating.

CLASSIFICATION 3, 4 - II - d

FIG. 14.—TYPICAL DUST SAMPLE RECORD CARD.

We further classify according to the nature of the work producing the dust as

(C) a. Grinding
b. Polishing
c. Dyeing
d. Handling
e. Gilding
f. Painting
g. Mixing
h. Cleaning
i. Pulverizing

With reference to this classification, it is to be understood that a given dust sample will not be confined to one particular group, that is, either A B or C, but will fall in all three. In classifying, therefore, a certain sample, we mention, first, its predominating characteristic, as will be noted on the attached record card. The classification of this sample is 3-4-II-d. Referring to this classification, we find that the sample is an infectious, obstructive, vegetable dust from the handling of the material.

A dust sample record for a systematic study of this subject is shown in the accompanying illustration. (Fig. 14).

DETERMINATION OF MAXIMUM DUST STANDARDS.

Having in mind a proper classification of air dust and a definite knowledge of the physiological, chemical and other effects of specific dust on the human organism, our next step should be to determine maximum dust standards, not only for schools, theatres and other public buildings, but particularly for those industries where the effect on the health of the workmen is of great importance. This can only be done by a thorough and comprehensive survey to determine the extent of air dustiness in the well-equipped and maintained factories, where every effort is being made by the use of dust-removing appliances, etc., to maintain a low dust condition, and also in other similar industries where proper precautions are not observed, or proper appliances used, determining in this way if air dustiness in the best establishments is sufficiently low to protect the heatlh of the workman. If it is, determine the extent of air dustiness and set a suitable standard. If it is not, dust-removing devices must be developed which will bring air conditions to the desired state of cleanliness. To do this, we must have a convenient and practical method of dust determination and a uniform method of recording results.

TEST METHODS.

From the foregoing discussion of air dust, we see the importance of rather exact information as to the amount and character of the dust in a given quantity of air. This information is not always easy to obtain and perhaps some of the difficulty in making dust determinations in the past has been due to the fact that the observer has been endeavoring to obtain exact data rather than data which are relative.

When we consider the nature of air dust, we are at once brought to a realization of the fact that all dust determinations must be relative. Individual dust particles exist in the air from a size that can be plainly seen by the naked eye, down, by more or less even graduations, to those that are so small that the most powerful microscope fails to reveal their presence. While it is not difficult to devise methods for collecting, counting or weighing the large particles, it is an entirely different matter when we attempt to collect and determine those that are almost infinitely small. In fact, to speak absolutely of the number of dust particles in a unit volume of air, or of their weight, is erroneous as these data can not be obtained. However, it is not necessary to arrive at absolute values in order that our methods give all the information desired. We should, naturally, come as close to absolute determinations as is possible, but it is of vastly more importance that our determinations are relatively correct.

I have been surprised on several occasions to note statements in the literature where the efficiency of various dust-determining devices has been mentioned. This is manifestly incorrect as the efficiency must necessarily refer to the absolute dust quantity in the air, or be based on a comparison with some other method. As absolute determinations are not possible and as no method has been universally recognized as standard, the term "efficiency" as referred to any method of dust-collecting or determination, cannot be properly employed.

(*To be continued*)

Status of Electric Heating on the Pacific Coast.

Reports of recent installations of electric heating appliances for warming buildings on the Pacific Coast has brought the following comments from Thomas Morrin, a consulting engineer of San Francisco, who has long specialized in heating and ventilating work:

"About July 1, 1922, the Matson Navigation Company began the erection of a 16-story office building, covering a 50 Vara lot (137 ft. 6 in. by 137 ft. 6 in.) in which they were anxious to use electricity for the direct radiation, but to compete with steam generated by oil fuel on the premises, it would be necessary to get a rate of 1 cent to 1¼ cents per kilowatt for the current used. This was on the basis, perhaps of 2 watts per cubic foot of space, in round numbers, with an unknown quantity of current in saturating the system. The wiring for the electrical distribution (A. C. single-phase 220-volts) would be but about 66% of the cost of the piping installation for low-pressure steam."

Rate sheets for steam and electricity as issued by the Great Western Power Company, one of the two very large distributors of both electricity and steam in San Francisco, are as follows:

ELECTRICITY.

Heating, Cooking and/or Water Heating Service.

First 150 kwh per meter per month.....3.5c per kwh
All Over 150 kwh per meter per month.....2.0c per kwh

STEAM

First	20,000 lbs. condensation per month	$1.50 per 1000 lbs.
Next	25,000 lbs. condensation per month	1.25 per 1000 lbs.
Next	35,000 lbs. condensation per month	1.10 per 1000 lbs.
Next	150,000 lbs. condensation per month	1.00 per 1000 lbs.
Next	170,000 lbs. condensation per month	90 per 1000 lbs.
All over	400,000 lbs. condensation per month	.75 per 1000 lbs.

This company, however, has not operated its service sufficiently long to develop an average cost sheet. The Pacific Gas & Electric Company and the Great Western Power Company each have new hydro-electric development, amounting to 90,000 H. P. and 60,000 H. P., respectively, for distribution throughout middle California and the San Francisco Bay district, which is now, or soon will be, ready for full distribution.

New Charts for Calculating Pipe Sizes for Water Flow

With Examples Showing Their Use Supplemented by Recent Test Data Proving Their Reliability

By F. E. Giesecke,

Head, Division of Engineering Research, University of Texas.

TO DETERMINE the proper size of a water pipe, it is necessary to know the quantity of water which is to flow through the pipe in a given time, the pressure which is available to produce the desired flow, and the laws which govern the flow of water in pipes.

The required quantity of water can be determined quite accurately. For domestic service, it is generally safe to estimate that every fixture should be supplied with water at the rate of 4 gal. per minute while it is in use and that the number of fixtures in use at any one time will vary from 100% of the total number installed, when that number is not greater than three, to 40% when that number is 100 or more.

For other than domestic service, the required quantity of water can be determined with similar accuracy.

The pressure which is to produce the required flow of water through the pipe may be obtained by a pump, or by a difference in elevation of the stations from and to which the water is to flow, or, in the case of gravity circulation of hot water, to the difference in density of water in the flow and return risers.

In every case the pressure may be expressed in pounds per square inch or in inches of water column, or in some other similar unit. The weight of fresh water at 70° F. is about 62.3 lbs. per cubic foot. Therefore, a water column of 1 ft. exerts a pressure of 0.433 lbs. per square inch, and a pressure of 1 lb. per square inch is equal to that of a water column 2.311 ft. high. For water at other temperatures and for water containing considerable quantities of solids, such as sea water, the relation between pressure and water column is somewhat different.

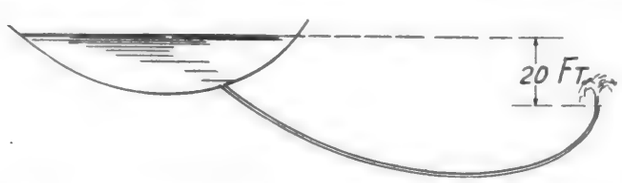


FIG. 1.—ILLUSTRATION OF A 20 FT. HEAD OF WATER.

In Fig. 1, for instance, the water is flowing from an elevated reservoir through a pipe and is being discharged at an elevation 20 ft. lower than that of the water in the reservoir; in this case the pressure producing the flow is the weight of a column of water 20 ft. high. This pressure may be described as "a head of 20 ft. of water," or, since water weighs about 62.3 lbs. per cubic foot, as "a pressure of 1246 lbs. per square foot, or 8.65 lbs. per square inch."

Fig. 2 shows a pump forcing water through a pipe. If the pressure against which the pump is working is 40 lbs. per square inch, the water will flow through the pipe in the same manner as if it were flowing out of a standpipe in which the upper level of the water is 92.4 ft. above the pump. The city of San Antonio, Texas, receives its supply of water by pumping from artesian wells directly into the mains, as shown in Fig. 2.

PRINCIPLE OF CIRCULATION IN A GRAVITY SYSTEM.

Fig. 3 shows a gravity circulating system supplying hot water in a four-story building. If the system is built so that the average temperature of the water in the return riser is 100° when the average temperature of the water in the flow riser is 120° and no hot water is being used, circulation will continue in the system because the water in the return riser is heavier than that in the flow riser. Since 100° water weighs 61.998 lbs. and 120° water 61.719 lbs. per cubic foot, the pressure producing circulation in this system is about 12.6 lbs. per square foot, or about 2½ in. of water.

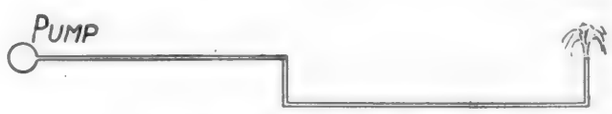


FIG. 2—WATER FLOW OBTAINED BY PUMP.

As this is a very low pressure, it is evident that extraordinary care must be exercised in designing water supply or water heating systems in which circulation is produced by gravity.

LAWS RELATING TO THE FLOW OF WATER IN PIPES.

In the system shown in Fig. 2, the pressure in the water flowing through the pipe is considerably higher at the pump than it is at the end of the pipe from which the water is being discharged. The difference between these two pressures is equal to the pressure which is consumed in overcoming the friction between the water and the inner wall of the pipe, and that in the water itself. This friction can, therefore, be expressed in the same units as the pressure, *i. e.*, in pounds per square inch, or in feet, or inches of water column. It is generally expressed in feet of water column and referred to as a friction-head of so many feet of water.

The friction-head is greater for long pipes than for short pipes, greater for small pipes than for large pipes and greater for high velocities than for low velocities. Just how the friction-head varies with the length and diameter of pipe, and with the velocity of the water can be determined only experimentally.

A number of investigators have given their attention

to this problem. The principal results of their investigations are described in an article entitled "Formulas for Friction-Heads in Water Pipes," and published in THE HEATING AND VENTILATING MAGAZINE, March, 1923.

The A. S. H. & V. E. Guide, 1922, page 149, gives the friction-head in 1 ft. of pipe as $0.00685 \frac{v^{1.77}}{d^{1.273}}$ and that in one standard elbow as $0.0141 \frac{v^{1.96}}{d^{0.26}}$

These values are average values determined by the writer in a number of series of tests conducted under his direction to secure accurate data for use in designing water heating systems. These investigations are described in full in University of Texas Bulletin No. 1759.

In order to calculate the friction head in a water pipe line it is generally necessary to know not only the friction-head due to one foot of pipe and that due to one ordinary 90° elbow, but also those due to various types of fittings, valves, radiators, and other apparatus which may be placed in the line and which will increase the friction-head in the same.

Having determined the friction-head due to such other fittings and apparatus, they may be expressed (with sufficient accuracy for all ordinary calculations) in terms of the friction-head due to one ordinary 90° elbow as shown in Table 1.

TABLE I.

Approximate friction-heads in fittings, valves, etc., expressed in terms of the friction-head in one ordinary elbow.

Coupling	0.1
45° elbow	0.5
90° elbow	1.0
Open return bend	1.0
Ordinary tee	2.0
Open gate valve	0.5
Open globe valve	12.0
Radiator with valve and union elbow	7.0

The values quoted in Table 1 were determined experimentally by the writer and published in DOMESTIC ENGINEERING of Nov. 2, 1912.

Since then they have also been published in Harding and Willard's "Mechanical Equipment of Buildings," Vol. 1, page 259, in Halsey's Handbook, page 240, and in Cosgrove's Principles of Plumbing, page 198.

The friction-heads given by the formulas quoted above apply only to new and clean iron pipe. After a pipe has been in service for some time its inner surface becomes rusty and foul and the friction-head considerably larger than it is in new clean pipe. Just how much the friction-head is increased depends on the length of service, on the character of the water, on the character of the pipe, and on the character of the service.

The writer tested 1½-in. galvanized-iron pipe which had been in service in a water heating system for 7 years and found that the friction-head had increased to such an extent that it was necessary to add about 17% to the coefficient and about 6% to the exponent of v, in the expressions quoted above, in order to express the friction-heads correctly.

FACTOR NEEDED IN FORMULA TO PROVIDE FOR INCREASE IN FRICTION WITH AGE

A formula which is to be used for designing pipe systems must evidently include a factor based on the increase in friction in the pipe due to age. Just what this factor should be must be determined by the designing engineer. The writer believes that under favorable conditions, for example, in heating systems in which the same water is used over and over again, or in water supply systems in which comparatively little fouling takes place, it is sufficient to add 15% to the coefficients and 5% to the exponent of v in the formulas quoted above. With these additions and suitable changes in units, the friction-head in one foot of pipe is $\frac{0.0948\ v^{\frac{1.88}{d\ 6.04}}}{d^{1.275}}$ inches of water column and that in one elbow is $\frac{0.195\ v^2}{d^{0.26}}$ inches of water column, where d is the

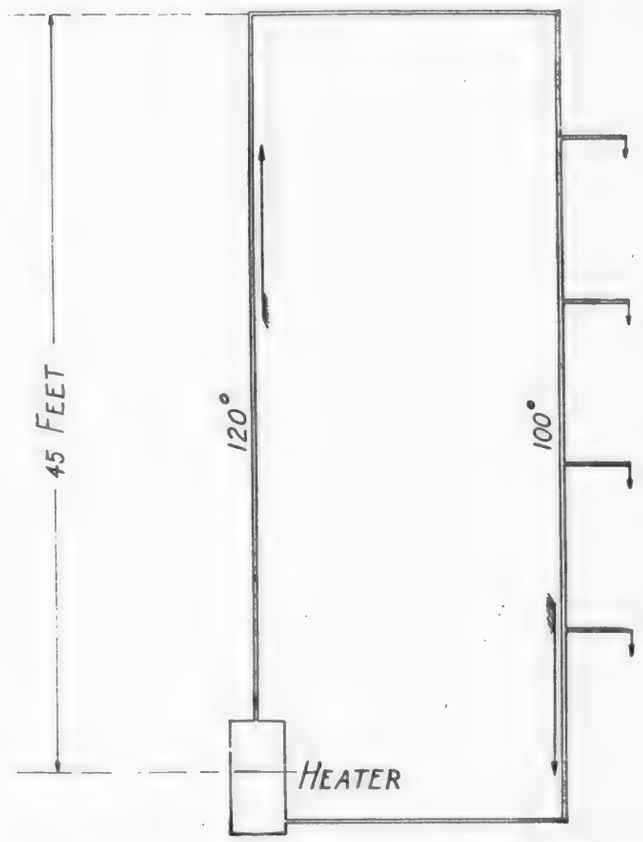


FIG. 3—GRAVITY CIRCULATING SYSTEM SUPPLYING HOT WATER IN A FOUR-STORY BUILDING.

actual internal diameter of the pipe in inches and v the velocity of the water in feet per second.

Since these formulas are difficult to apply, the diagram of Figs. 4 and 5 have been prepared and the friction-heads can be easily determined from them.

CHARTS FOR FIGURING FRICTION-HEADS.

In these two diagrams the sloping full lines represent the nominal diameter of the pipe in inches and the sloping dotted lines represent the velocity of the water in inches per second (not in feet, as might be supposed, since v in the formula is in feet.)

To understand the use of these two diagrams, note from Fig. 4 that when 200 gal. per minute flow through a 6-in. pipe, the friction-head is 4/100 in. per foot of pipe and the velocity of the water between 24 in. and 36 in. per second; also that for 30 gal. and a 2½-in. pipe the friction-head is 1/10-in. per foot of pipe and the velocity slightly less than 24 in. per second. From Fig. 5, when 200 gal. of water per minute are flowing through a 6-in. pipe, the velocity of the water is between 24 in. and 36 in. per second, and the friction-head is about 6/100 in. of water column for each elbow; also for 30 gal. and a 2½-in. pipe, the friction-head is about 53/100 in. per elbow, and the velocity slightly less than 24 in. per second.

Referring again to Fig. 2, the pressure which exists in the water at the open end of the pipe, *i. e.*, the pressure which remains after the friction-head has been deducted from the pressure-head produced by the pump, is consumed in forcing the water out of the pipe. The velocity with which the water is forced out of the pipe depends upon the pressure. The relation between the two is the same as that between the velocity acquired by a particle of water falling a certain distance and the distance through which it has fallen, and is expressed by the formula $h=v^2/2g$, where h is the velocity-head in feet, v is the increase in velocity in feet per second acquired by the particle of water during its descent, and g is the increase in velocity due to gravity, in feet per second each second. The value of g is about 32.2 ft./sec.^{2} The velocity-head, h, is the height the particle of water must fall if it acquires the velocity v, after starting from rest, or the height to which it will rise (in the case shown in Fig. 2) before coming to rest after leaving the pipe with a velocity v.

In the case shown in Fig. 2, the pressure-head produced by the pump is equal to the friction-head in the pipe line, plus the velocity-head available at the end of the pipe and forcing the water out of the pipe.

Having discussed the principal laws governing the flow of water in pipes and described the use of Table 1 and of the diagrams of Figs. 4 and 5, the practical application of the information can best be shown by the solution of a series of illustrative problems.*

PRACTICAL APPLICATIONS.

Example 1. What pressure-head must be maintained by the pump shown in Fig. 2 if 10 gal. per minute flow through a 1-in. pipe 142 ft. long and containing seven elbows?

We find from Fig. 4 that for 10 gal. per minute flowing through a 1-in. pipe, the velocity is practically 44 in. per second and the friction-head per foot of pipe is 1.05 in., and from Fig. 5 that the friction-head per elbow is practically 2.8 in.

It should be noted here that the velocities shown in Fig. 5 are not those in the elbow but those in the pipe which the elbow fits.

The total friction-head is, therefore,

142 x 1.05 = 149.2 for the pipe
7 x 2.8 = 19.6 for the elbow
Total 168.8 in. of water column.

* The editor and the author solicit other problems for incorporation in this series or as a sequel thereto.

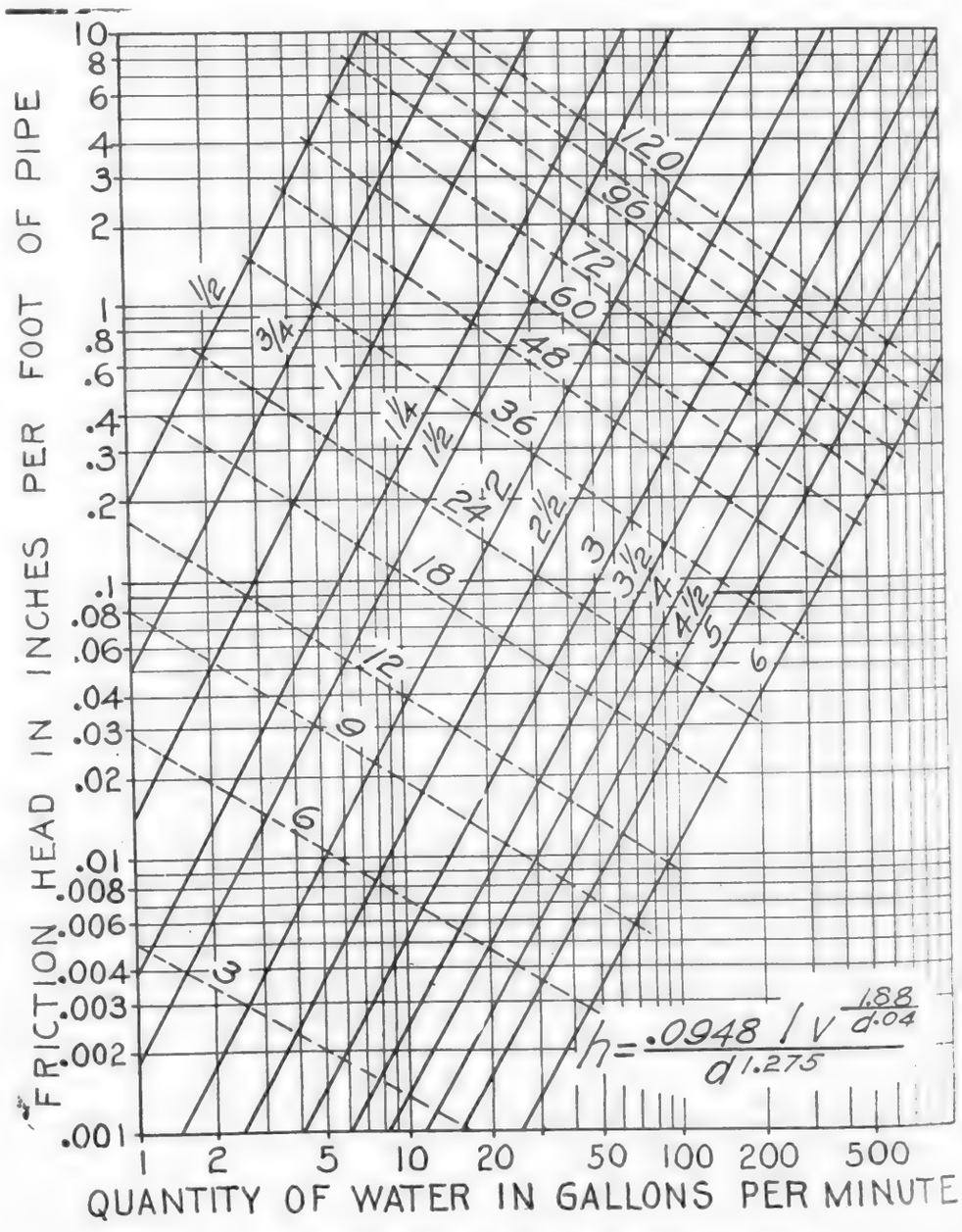


FIG. 4—FRICTION HEAD IN INCHES PER FOOT OF PIPE.

The velocity head is $\frac{4 \times 4}{64.4} = 0.25$ feet or 3 in.

Therefore, the pump must maintain a pressure-head of 169 + 3 = 172 in., or 14.3 ft. of water column, or 6.2 lbs. per square inch: The water will be thrown about 3 in. into the air if it is discharged from the open end of the 1-in. pipe.

ANOTHER EXAMPLE.

Example 2. What pressure must be maintained by the pump in the system described in Example 1 if 12½ gal. of water flow through the pipe and if an open globe valve is added to the line?

Note from Table 1 that the friction in an open globe valve is approximately equal to that in twelve elbows and proceed exactly as in Example 1. The velocity is about 4.5 ft. per second and, therefore, the velocity-head is 4 in. The friction-head is about 1.6 in. per foot of pipe and 4.3 in. per elbow. The total friction-head is 142 x 1.6 + 19 x 4.3 = 25.8 ft. and the total pressure-head is 26.1 ft.

TESTS OF WATER FLOW IN 1-IN PIPES.

In order to test the accuracy of the solution of Examples 1 and 2, two senior students in architectural engineering at the University of Texas, W. M. Wilson and C. C. Wright, laid a line of new 1-in. pipe and conducted three series of tests. In the first series the pipe line consisted of 142 ft. of pipe and five elbows; in the second series, an open gate valve was added to the line; and in the third series, an open globe valve was substituted for the open gate valve used in the second series.

In each of the three series three separate tests were made with three different pressure-heads. The pressure-heads were secured by means of a tank in which the elevation of the water could be maintained at a constant height and measured accurately.

Fig. 6 shows the friction-heads in feet of water, corresponding to the nine tests and plotted against the flow of water, in gallons per minute through the pipe line. It is evident from the figure that the friction in an open gate valve is so small as to be negligible and that the friction in the open globe valve was as much as 24% of that in the entire line of 142 ft. of pipe and five elbows, or that it was approximately equal to that in 37 ft. of pipe, or to that in 13 elbows.

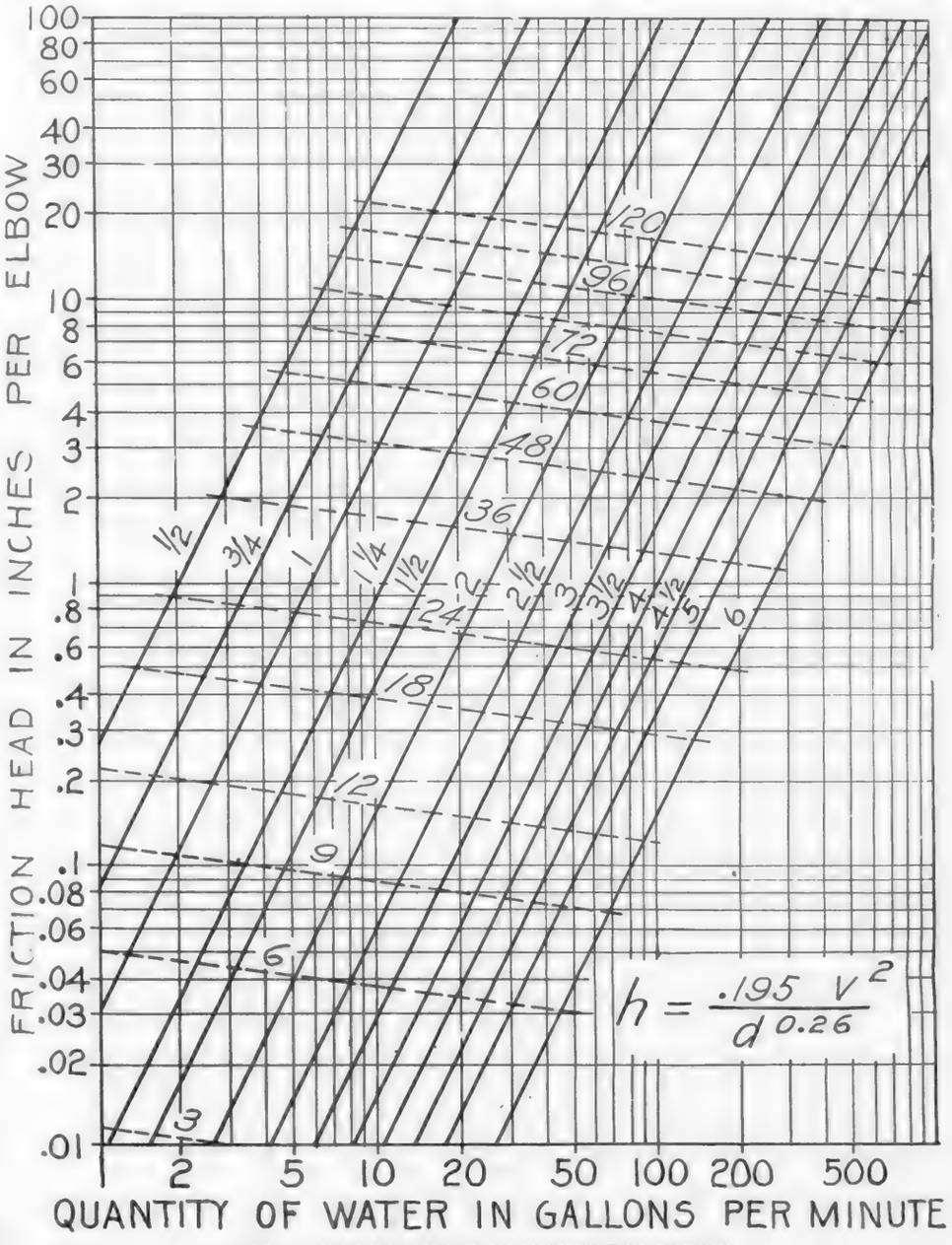


FIG. 5—FRICTION HEAD IN INCHES PER ELBOW

Comparing now the pressure-heads calculated in Examples 1 and 2 with those shown in Fig. 6, it is evident that the results secured by means of the diagrams (Figs. 4 and 5) are considerably on the side of safety when applied to new and clean iron pipe. As explained above, this allowance was made intentionally to provide for a considerable increase in friction due to probable rusting of the pipe with age.

Fig. 7 shows a portion of the experimental installation when 12.48 gal. were flowing through the pipe. The calculated velocity-head for this case is 4 in. and this agrees well with the actual velocity-head, as can be seen from Fig. 7 by comparing the height of the water jet with the outside diameter of the 1-in pipe.

In Examples 1 and 2,

seven elbows were included in the calculation for the friction-head, instead of the five actually used, because it was assumed that the friction due to the flow of water from the tank into the pipe would be approximately equal to that in two elbows.

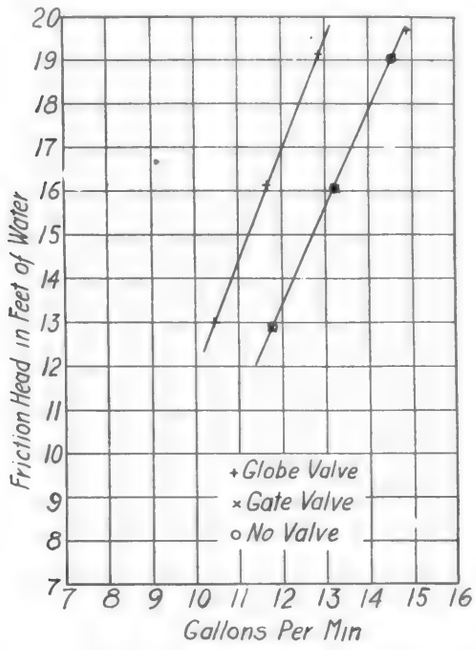


FIG. 6—FRICTION HEADS IN FEET OF WATER CORRESPONDING TO THE NINE TESTS AND PLOTTED AGAINST THE FLOW OF WATER.

Example 3. Referring to Fig. 2 and assuming that the pipe line is changed so that the open end of the pipe is 40 ft. higher than the pump, what pressure-head must be maintained by the pump if 10 gal. per minute are to flow through the pipe?

In this case the velocity-head and the pressure-head will be the same as in Example 1 and, in addition, the pump must raise the water 40 ft. The total required pressure-head, therefore, will be

Velocity-head	0.25
Friction-head	34.95
Elevation-head	40.00
	75.20

ft. of water column, or 32.6 lbs. per square inch.

FIG. 7—PORTION OF THE EXPERIMENTAL INSTALLATION WHEN 12.84 GAL. PER MINUTE WERE FLOWING THROUGH A 1-IN. PIPE, 142 FT. LONG, WITH SEVEN ELBOWS AND ONE OPEN GLOBE VALVE, DUE TO A PRESSURE-HEAD OF 19.2 FT.

Example 4. Referring again to Fig. 2 and assuming that the pipe line has been changed so that the open end of the pipe line is 40 ft. lower than the pump, what pressure-head must be maintained by the pump if 10 gal. per minute are to flow through the pipe?

In this case, the velocity-head, friction-head, and elevation-head will be the same as those in Example 3, with the difference, however, that. in this case, the elevation-head will act with the pump and against the

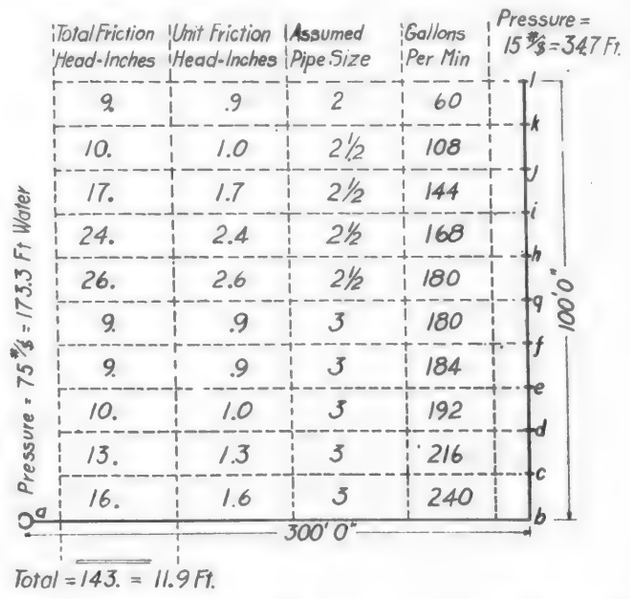


FIG. 9—DIAGRAM OF SYSTEM INTENDED TO SUPPLY WATER TO A 10-STORY BUILDING.

friction-head, instead of with the friction-head and against the pump, as in Example 3. The total required pressure-head, therefore, will be —4.8 ft. of water column, or —2.08 lbs. per square inch. In other words, the pump will be required to restrict the flow of water, instead of producing or assisting it. This means that the pump would not be necessary, but that a valve would have to be inserted in the line, probably near the outlet of the pipe and partially closed so that the friction-head due to the partially-closed valve will be 4.8 ft. of water column.

Example 5. Let it be required to determine the pipe sizes for the system shown in Fig. 9, and intended to supply water to a 10-story building.

This problem is one submitted and solved by W. S. Timmis, A.S.H.&V.E. Guide, 1922, and is introduced

FIG. 8—VIEW SHOWING 14.5 GAL PER MINUTE FLOWING THROUGH A 1-IN. PIPE 142 FT. LONG, WITH SEVEN ELBOWS AND NO VALVE, DUE TO A PRESSURE-HEAD OF 19.1 Ft.

here simply to show the ease with which such problems may be solved by means of the diagrams (Figs. 4 and 5.)

The general arrangement of the system is shown in Fig. 9.

The pipe line begins at the point *a* (the connection to the main) and extends horizontally 300 ft. to the building and then vertically in the building 100 ft. to the point *l* on the tenth floor.

By the conditions of the problem the available pressure-head at the point *a* is 173.3 ft. and the required pressure-head at the point *l* is 34.7 feet. The difference between these two pressure-heads is the sum of the elevation-head (100 ft.) between the points *a* and *l*, and the friction-head from *a* to *l*; the latter is therefore 38.6 ft. and may be distributed along the 400 ft. of pipe in many different ways. Some designers like to maintain a uniform velocity throughout the length of the pipe; others prefer to have a uniform friction-head along the pipe. Probably the best plan to adopt is to distribute the friction-head in such a way as to make the cost of the resulting pipe line as low as possible.

The maximum quantity of water assumed to be flowing through the pipe at any one time varies, by the conditions of the problem, as shown in Fig. 9, from a maximum of 240 gal. per minute at the point *a* to a maximum of 60 gal. at the point *l*.

In order to simplify the design, the pipe line has been divided in eleven sections designated, respectively *ab, bc, cd . . . jk, kl*. The division is made so that the velocity of the water is constant in any one section. Hence a division point must occur wherever the quantity of water changes and wherever the pipe size is changed.

Having divided the line into a number of sections and knowing the quantity of water flowing in each section, as shown in Fig. 9, and knowing also the total friction-head (38.6 ft. in 400 ft., or, on the average, 1.156 in. per foot of pipe) the line may be designed as follows:

It appears from Fig. 9 that in section *kl* the quantity of water flowing is 60 gal. per minute; it appears from Fig. 4 that for 60 gal. and a friction-head of 1.156 in. per foot the pipe size must be slightly smaller than 2 in. and considerably larger than 1 1/2 in. Hence we will select a 2-in. pipe for this section. We find from Fig. 4 that for a 2-in. pipe and 60 gal., the friction-head is 0.9 in. per foot, or 9 in. in 10 ft. (the length of section *kl*). These values are recorded in Fig. 9.

Similarly we find from Fig. 9 that 240 gal. flow in section *ab* and from Fig. 4 that for 240 gal. and a friction-head of 1.156 in., the correct size of pipe is about 3 1/4 in. Since there is no standard pipe of that size we will select the 3½ in. pipe for section *ab* or, at least, for a considerable part of that section.

We know now that the pipe size should be 3½ in. at *b* and 2 in. at *l*, with a gradual change from 3½ in. to 2 in. Just how to change from 3½ in. to 2 in. is not very material. We may select the sizes as shown in Fig. 9, find the unit friction-head for each section from Fig. 4 and record the same and calculate the total friction-head from *b* to *l* to be 11.9 ft., as shown in Fig. 9.

If we then select a 3½-in. pipe for section *al*, the friction-head in the same would be (300 x 0.75)/12 = 18.8 ft.. The total friction-head from *a* to *l* would be 11.9 + 18.8, or 30.7 ft., or 7.9 ft. less than that available. The pressure-head at *l* would then be 7.9 ft. more than that required by the condition of the problem.

If we desire to use all available friction-head, it is necessary simply to select a 3-in. pipe for a portion of section *ab*. Since the friction in a 3-in. pipe is 1.6 and in a 3½-in. pipe, 0.75, when 240 gal. are flowing per minute, the friction-head will be increased by 1.6—0.75 = 0.95 in. for every foot of 3-in. pipe used to replace a foot of 3½-in. pipe. Since we have 7.9 ft. or 94.8 in. available for additional friction, we may use 94.8/0.95, or 100 ft. of 3-in. and 200 ft. of 3½-in. pipe in section *ab*. This length of 100 ft. of 3-in. pipe may be inserted anywhere in section *ab*, but it would generally be inserted next to the building.

It must be remembered that if this installation were made as calculated above, the pressure-head at *l* would be considerably more than 34.7 ft., so long as the entire pipe line is clean. The pressure-head would drop to 34.7 ft. only after considerable fouling has taken place in the pipe.

In the above calculation the velocity-head at *l* was neglected because it will be produced by the pressure-head reserved for the end of the last section. The friction-head due to elbows was neglected because there was only one elbow and its effect is negligible in comparison with that of 400 ft. of pipe.

New Steam Boilers Double Efficiency

(By Science Service.)

Engineers in America are taking great interest in the sensational development of very high pressure steam boilers in Sweden. This apparatus instead of operating at 300 or 400 lbs. as a maximum which is usually regarded as the greatest pressure for safe practice, is making steam at 900 lbs. regularly. And modified designs which promise to be entirely satisfactory at 1,500 lbs. per square inch, or one hundred times atmospheric pressure, have been prepared.

By increasing steam pressure in this fashion the boiler plant will furnish its power to the engine under conditions that will increase the efficiency of the engine by 6 per cent. to 100 per cent., depending upon the type of equipment. Such an increase realized in many steam power plants would be a big factor in these days of high fuel prices.

This new steam boiler has several novel features among the most novel of which is the generation of steam in rotating boiler tubes. The rotation of the tubes keeps all sides of the tube wet with water and tends to bring the steam bubbles all to the center of the tube so that a great deal more water can be evaporated than under ordinary conditions. It is claimed that 60 lbs. of water per square foot of tube surface is evaporated and in some cases a hundred pounds per hour is possible. This is several times the maximum rate of steam and in the most efficient American boilers.

The success achieved in operating this equipment for over a year at Gothenburg, Sweden, indicates that American engineers will soon be trying out similar equipment in the United States.

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IF ANYTHING were needed to show how rapidly the science of ventilation has advanced in the past few years, it is furnished by the report, just published, of the New York State Commission on Ventilation. This report covers an investigation which was started in 1913 and concluded in 1917. It is important to remember these dates in studying the commission's findings. Consider, for instance, the statement that "the practice of recirculation of schoolroom air, and the humidification of the air supply to rooms, as adjuncts to systems of fan ventilation, have not yielded good results in the hands of the commission, and are not recommended." In the light of what we now know about the use of ozone and air washers in the recirculation of air for ventilating purposes, this statement sounds strange indeed and the unconvincing impression it makes is deepened when we find that the commission's entire study of the effects of ozone was confined to a single school building with a type of ozonizer that is now obsolete. "This system," declares the report (a fan system in which the air was recirculated and ozone admitted in varying concentrations on the suction side of the blower) "was tried on many different days during the fall and winter experiment, but the ozone appeared to give no relief from odor and in fact seemed to make things worse by superposing the odor of ozone upon the body odors." All of which may be perfectly true, but is absolutely at variance with the experience of those who have observed the effects of ozone in recirculated schoolroom air over periods of many times nineteen days and even nineteen months.

WE BELIEVE it is safe to say that the admission of cold air from outdoors directly through the windows will not be tolerated in American school buildings. In recommending open-window ventilation, the commission is careful to state that "we are forced to conclude that window ventilation with ample direct radiation, window deflectors and adequate gravity exhaust, seems the most generally promising method for the ventilation of the classroom where local conditions permit its use." If the report had added that such incoming cold air should be carried by some means directly to the ceiling and there diffused in every possible direction it might have found a responsive echo, especially among those who have had to satisfy the vagaries of different groups of school teachers and who have found that the only way to cope successfully with the situation is to treat every classroom as if it were a separate building by itself. We think it strange that no comment is made by the commission as to the effect of open-window ventilation on the pupils near the outer walls. To be sure the sensations of an observer are recorded, but it is not stated whether the observer was stationed near the windows or elsewhere in the room. No comment is made, either, as to any method for controlling the inflow of cold air at the window's meeting-rail. Even with radiators extending the full width of the windows and using approved deflectors at the bottom of the window openings, it is notorious that the incoming cold air, very frequently, will not follow the nice arrows pointing upward, but will execute a right-about turn and fall "like a thousand of brick" long before it has become even moderately warmed.

HAVING expressed these dissenting views from the conclusions of the commission, at the same time we feel that the report, with its wealth of data, is one that will contribute very largely to the advancement of the science of ventilation. On such subjects, for instance, as the effect of cloth window screens, the information brought out should settle once and for all the inadequacy of this method. In its review of the art, also, the report will rank as a classic. Moroeover, many of the tests recorded, such as those dealing with the physiological reactions to atmospheric conditions, will not have to be repeated by future experimeters, as the results speak for themselves and will be accepted as conclusive.

The field investigations were even more extensive than was generally known and some of these, especially the Sherman School test, in Fairfield, Conn., with fan-ventilated and window-ventilated rooms, so far as we know, have never before been published. As many of the commission's findings are based upon this test, the data obtained will merit close study.

Speaking generally, the commission has done a wonderful piece of work and stands for the most part on solid ground. We agree with the statement that "the full report . . . will constitute a permanent contribution to this branch of science." That it will result, however, "in general improvement of health and hygienic conditions, particularly among the school children of the land," which was the primary purpose of the investigation, depends, in our judgment, upon the way the conclusions are modified, in the light of more recent experience and the latest advance in the technique of the art, so far as they apply to window ventilation, recirculation of indoor air and the use of ozone.

Prices of Heating Equipment to Vary With Cost of Production During the Year

Important Plan Announced by the American Radiator Company Expected to Go a Long Way Towards Solving the Problem of Seasonable Demand in the Building Industry

One of the principal reasons why building costs are high, it is generally agreed, is because in normal times the work is crowded into a few months of the year. The great essential industry of building has its season as definitely as though it were only a summer vacation hotel.

It is an extraordinary condition for a great industry and one from which no one benefits. Therefore, the attempt by the American Radiator Company, which is now in effect, to cut the seasonal variation in its portion of the industry is a movement which is likely to mark an epoch in this field.

To express the plan briefly, the company has decided to sell its product at prices based on the cost of production during each period of the year, instead of averaging production costs through the year and selling at one price. Under the direction of Clarence M. Woolley, president of the company, engineers and cost accountants found that, even when there is no advance in the price of raw materials, it cost 13% more to produce during the peak season than during the period of slack demand.

Taking their factory production records and their shipments for the past 20 years they plotted a chart, dividing the year into five periods. The first period includes February, March and April. In this period they found that their production was just about twice as great as shipments. This surplus production had to be stored. The second period was May and June, when production is about one-third larger than shipments. The third period is July and August when for the first time shipments begin to exceed production.

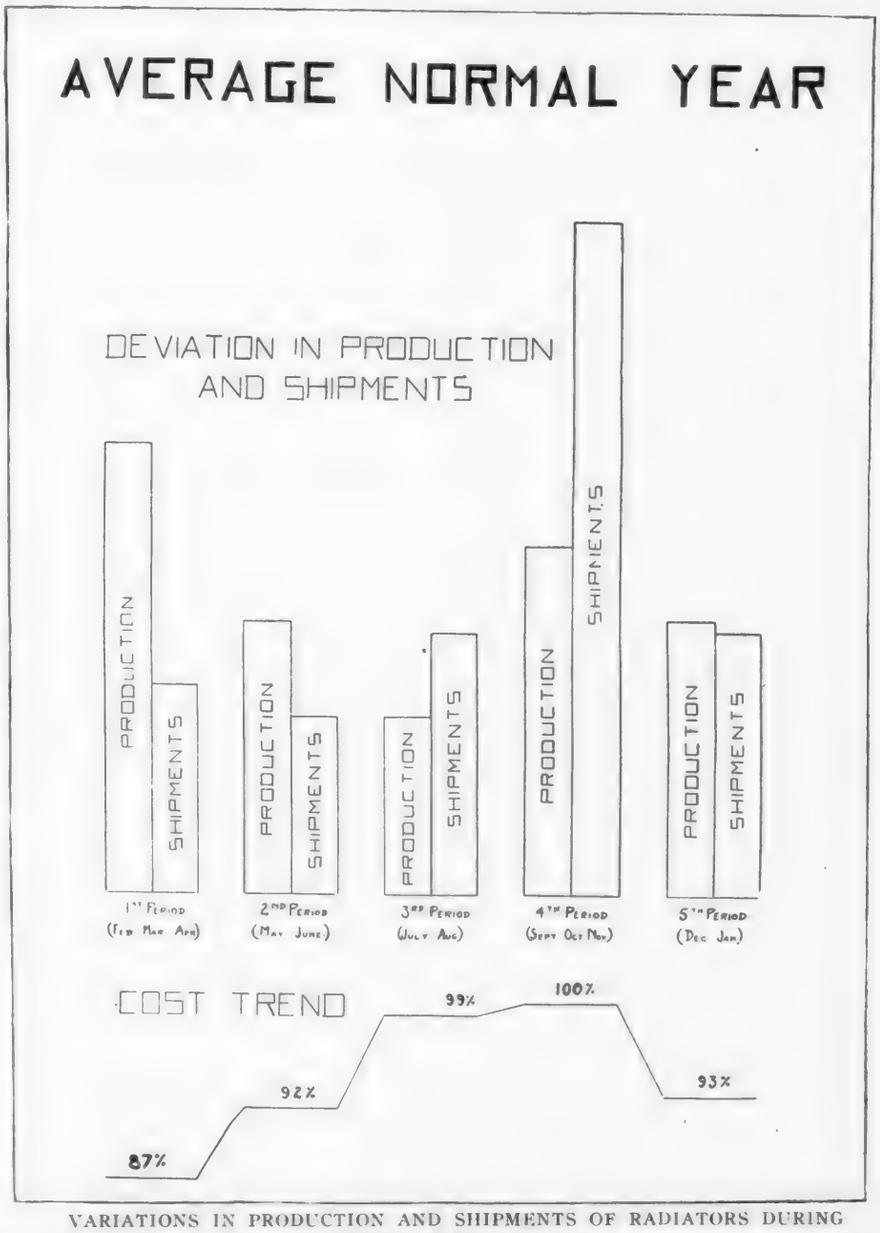
In the fourth period, September, October and November comes the rush. In these months the company ships more than in the first three periods put together. The fifth period is December and January when shipments drop to about one-third of those in the fourth period and production again exceeds consumption.

Cost accountants figured out the cost of production for each period. It was found the company could take business profitably at a lower price in the first period than it could in the fourth period—they could take it at so much lower price that it would pay the owner to instruct the contractor to buy at the low period, take delivery and store the goods on the premises of the owner until needed for installation in the fall.

That is exactly the plan the company has decided upon. They are taking the fourth period—September to November—as the normal price of 100%. Then they work down according to the costs of production. The first period is the low cost; therefore their prices are 92% of normal, or 8% off. The second period is 94%, the third period is 97%, the fourth period is normal, and the fifth—December and January—is 98%.

HOW THE PLAN WORKS OUT.

An example of the operation of the new plan is that of a contractor who has in April a heating contract requiring 3,000 sq. ft. of radiation; the premises will not be ready for the installation until about September. If he buys radiation in April and takes delivery he will get it at 0.416 cents per square foot. If he waits until September it will cost him 0.452 cents per square foot or, to put it in dollars, it will cost him $1,356 in the last period as against $1,248 in the first, a difference of $108. The interest on $1,248 for four months is $24.29, so his net saving is $93.71—which is at the rate of 20% a year on his $1,248 investment. The 20% does not come out of the company—the company does not give discount except in words. That 20% is a dividend from waste—from the waste of costly



VARIATIONS IN PRODUCTION AND SHIPMENTS OF RADIATORS DURING AVERAGE NORMAL YEAR.

handling and storage, from the waste of unbalanced production.

GETTING AWAY FROM THE "SEASONS" OF BUSINESS.

The rearrangement is not merely one of prices—it is a step in the direction of getting away from the seasons of business. If heating materials can be so sold, the company believes, then other materials which have the same seasonal wastes can be so sold. That will give heavy inducement to building out of what is now called the season and relieve the peak of building. This will in turn mean that "overhead," mechanics' wages, and profits can be calculated by the year instead of by the day, which would make for ever lowering costs and hence for more work, wages and profits.

The American Radiator Company started its investigation as a result of the work of a committee of engineers with Secretary of Commerce Herbert Hoover as chairman about a year ago. That committee of which Mr. Woolley was a member, surveyed the industries of the nation and reported that seasonal operation was at the bottom of most of the troubles in the building industry.

Everyone knows that the most of our coal troubles are due to the seasonal buying of coal. The whole country thinks about putting in its coal when it begins to get cold. There are not enough miners to supply the domestic consumption in a month. There are not enough coal cars to carry the coal.

In many respects the building industry is worse off than the coal business and for the same reason. Comparatively little work can be carried on in most localities during the very cold weather. We have gone forward on the assumption that builders are not free agents but are at the call of the weather man.

EXPENSE OF FORCED PRODUCTION.

Every one knows that forced production is expensive. The American Radiator Company found that, although managers made every effort to speed up production during the rush season, the factories never got within 20% or 25% of the production during the first period when good men were obtainable and schedules might have been followed.

One of the reasons why Ford automobiles are so cheap is that the factory works so steadily. The whole production is planned and the plans cannot be deviated from. It would probably cost $10,000 just to send a Ford through unpainted—special instructions would have to be given and observing these instructions would hold up the flow of work.

One of the most significant facts disclosed in the plan of the American Radiator Company is the appalling waste of seasonal production and selling. The company has to add the waste to the cost of the product; the contractor has to add it to the cost of his contract; the owner has to foot the bill. But what difference does it make, some query, since it is the owner and not the company or the contractor who pays the bill. Just this difference. Every penny that is unnecessarily added to cost limits the market. Nearly all the articles which are called necessities today are necessities only because they are cheap.

If it cost $10,000 to put a heating plant into a nine-room dwelling, then the nine-room dwellings with heating plants would be curiosities. There would practically be no heating business. The secret of good business, the company decided, is not testing what the traffic will bear, but seeing how much the traffic can be induced to use.

To Develop a Code of Minimum Requirements for the Heating and Ventilation of Buildings

Few undertakings of the American Society of Heating and Ventilating Engineers have been more ambitious than the project it has recently undertaken to develop a code to cover the minimum requirements for the heating and ventilating of buildings. This matter was recently brought to a head when the American Engineering Standards Committee was considering the society's "Requirements for Model Compulsory Heating and Ventilation Laws," promulgated in 1915. After studying this code the A. E. S. C., through its Special Committee on Approval of Ventilation Code," referred the matter back to the society "in order that a revision at the hands of a thoroughly-representative sectional committee might insure its acceptability to all interested bodies." One of the specific points on which the code was found to be in need of revision was the requirement expressed throughout that all ventilation was to be furnished by pure "outdoor" air. This precluded the practice of recirculating the air.

According to present plans it is proposed to develop a code which will be in shape to be adopted by various municipalities and incorporated as a part of their building codes. It is the intention of the committee that the application of all formulas, diagrams and tables be illustrated by examples and illustrations will be used whenever necessary to fully explain the application.

The code is to be limited in application to the design of heating and ventilating installations as a whole and in no way is to be construed to cover the design of the various equipments used. The method of rating certain equipment that has become standardized by various manufacturers' associations will naturally be adopted in this code.

According to the present plans another feature of the code will be a recommended uniform method of specifying various heating and ventilating apparatus, as well as a standard code of symbols.

PERSONNEL OF THE COMMITTEE

The committee will be headed by Louis A. Harding, of the engineering firm of Harding & Crea, of Buffalo, N. Y. Mr. Harding is perhaps most widely known as the co-author of Harding and Willard's monumental work on "Mechanical Equipment of Buildings."

No less than fifteen sub-committees have been appointed to take up the various items in the code, as follows:

Section I—DEFINITION of terms in common use as applied to heating and ventilating, formulae for physical limits, properties of Water steam and vapor Mixtures, DEAN F. PAUL ANDERSON, chairman.

Section II—Minimum ventilation requirements—for churches, schools, hospitals, asylums, prisons, public buildings, theatres, assembly halls, moving picture houses and certain types of factory buildings, E. VERNON HILL, chairman.

Section III — Standard method for determining outside temperatures and temperature differences for the design of heating systems, F. R. STILL, chairman.

Section IV — Minimum requirements for estimating the heat to be supplied for warming buildings, PROF. J. D. HOFFMAN, chairman.

Section V—Minimum requirements for the determination of the amount of direct steam or hot water radiating surface to be installed in steam and water heating systems, C. L. RILEY, chairman.

Section VI—Minimum requirements for the determination of the amount of indirect steam or hot water radiating surface to be installed in indirect (gravity and fan circulation) heating systems, L. C. SOULE, chairman.

Section VII—Minimum capacity and installation requirements for heating boilers, FREDK. W. HERENDEEN, chairman.

Section VIII—Minimum requirements for the design and installation of warm-air furnace heating systems, PROF. A. C. WILLARD, chairman.

Section IX—Minimum requirements for the design and installation of smoke flues, breechings and chimneys or stacks for steam boilers, water boilers and warm-air furnaces, J. R. McCOLL, chairman.

Section X—Minimum requirements of pipe sizes for use with low-pressure steam, vapor and vacuum heating systems, JAMES A. DONNELLY, chairman.

Section XI—Minimum requirements of pipe sizes for use with water heating systems, W. S. TIMMIS, chairman.

Section XII—Minimum requirements for the design and installation of air ducts in conjunction with fan air circulation and the installation of ventilating fans for heating and ventilating systems, C. A. BOOTH, chairman.

Section XIII—Minimum requirements for the installation of air washers and humidifiers for heating and ventilating systems, WILLIS H. CARRIER, chairman.

Section XIV—Minimum requirements for the installation of centrifugal rotary and reciprocating pumps for heating systems, PERRY WEST, chairman.

Section XV—Standard symbols for heating and ventilating drawings, R. C. COLLAMORE, chairman.

New Jersey's Engineers' License Law.

The provisions of the new law in New Jersey requiring professional engineers to obtain licenses from the New Jersey State Board of Professional Engineers and Land Surveyors are now in effect. Under the terms of the act any person who practises the profession of engineer, other than those employed by the federal or State governments, or non-resident engineers who have licenses in their own States, must make application for a license.

After two years from April 8, 1921, any person who fails to obtain the legal authority to practise the engineering profession may be found guilty of a misdemeanor.

The New Jersey Board requires a fee of $25 to $35 for the licenses which are issued for the period of one year. The fee for renewal is $1 if renewal is obtained in April of each year. The fee is increased by 10% for each month after April, except that the maximum fee for delayed renewal is fixed at $2.

Applications for licenses should be made to the State Board of Professional Engineers and Land Surveyors, 710 Trust Co. of N. J. Building, Jersey City, N. J.

Effect of Temperature on Human Body.

Several common beliefs have been shattered recently in the scientific research conducted in Pittsburgh by the American Society of Heating and Ventilating Engineers, in cooperation with the U. S. Bureau of Mines and the Carnegie Institute of Technology. It was learned for instance that fat men endure high temperature and humidity better than thin men. Another fact brought out was that drinking ice water does not develop cramps in men after they have been subjected to an hour's exposure to high temperature.

The problem of the exact degree of temperature and of humidity to which persons should be subjected in a room was attacked several years ago but not until recently had the research reached a point where definite conclusions might be drawn. The society had also in these experiments the cooperation of the United States Public Health Service, and one of the first tests was to study the physiological effects of various temperatures and humidities on human subjects at rest in still air. A staff of physicians and others subjected themselves to great hardships in the course of the research work.

An important result of the experiment was the discovery of the great variations of external temperature which the human being can endure, and at the same time, retain his physiological efficiency. Another interesting fact disclosed was that increasing pulse-rate is more the cause of discomfort than is body temperature, when in a heated room.

Referring to ice-water tests, the report states:

"It has frequently been stated that workers exposed to high temperatures developed severe cramps after drinking ice water. A few of the subjects of these experiments volunteered to drink ice water after about an hour's exposure to high temperature, and two of them, in one experiment, drank a quart of ice water in less than fifteen minutes without ill effects. Cramps did not develop in any of the subjects at any time."

Other experiments disclosed the fact that loss of weight varied with the individual on entering and leaving specially heated chambers, the heavier and stouter men losing more than did the light and thin ones. It was shown also that the lighter man, as a rule, could not endure the temperature conditions as long as the heavier one, and that he complained more of the exhaustion which followed the experiment.

Manufacture of Warm-Air Furnaces and Stoves in 1921.

Newly-published statistics on the value of products of establishments engaged primarily in the manufacture of warm-air furnaces and stoves, compiled by the Bureau of the Census, contain the significant figures of $101,558,000 in 1921, as compared with $145,718,000 in 1919, and $67,941,000 in 1914. This represents a decrease of 30% from 1919 to 1921, but an increase of 49% for the seven-year period from 1914 to 1921. In addition, warm-air furnaces and stoves were also manufactured as a subsidiary product by establishments engaged in other industries to the value of $2,449,000 in 1921, $1,706,000 in 1919, and $1,861,000 in 1914.

The statistics for 1921, 1919, and 1914 are summarized in the following statement:

	1921[1]	1919[1]	1914[1]
Number of establishments	356	400	410
Persons engaged	29,090	39,153	34,674
Proprietors and firm members	165	139	226
Salaried employees	4,394	6,146	4,913
Wage earners (average number)	24,531	32,868	29,535
Salaries and wages	$40,185,000	$54,618,000	$27,843,000
Salaries	10,357,000	13,297,000	7,066,000
Wages	29,828,000	41,321,000	20,777,000
Contract work	215,000	123,000	136,000
Cost of materials	40,990,000	54,803,000	23,802,000
Value of products	101,558,000	145,718,000	67,941,000
Value added by manufacture[2]	60,568,000	90,915,000	44,139,000

[1] Statistics for establishments with products valued at less than $5,000 are not included in the figures for 1921. There were five establishments of this class, reporting no wage earners and products valued at $17,000. For 1919, however, data for twelve establishments of this class, reporting eight wage earners, and products valued at $33,000, and for 1914, data for 28 such establishments, with 52 wage earners and products to the value of $84,000, are included in all items with the exception of "number of establishments."

[2] Value of products less cost of materials.

Need of Ventilating Provisions in Street Tunnels.

How the need for ventilation in street tunnels has increased with the growth of the automobile traffic is illustrated in the case of the Second Street Tunnel, in Los Angeles, Cal. In a statement on the subject received from City Engineer John A. Griffin, and commenting on a report that he had asked the city council for permission to install five blowers to take care of the exhaust gases, smoke and fumes, he states:

"The Second Street Tunnel is still in process of construction. It is 1502 ft. long, portal to portal, and has a clear span of 50 ft. and a height of 27½ ft., thus giving a large cross-sectional area in comparison to length.

"At the time the plans were made, in 1916, motor vehicle traffic was far less than at present and a special ventilating system for the tunnel was not considered necessary. The contractor constructing the tunnel has sunk five working shafts along the center line of the tunnel, each about 5 ft. square, and four of these will be lined with concrete and left open to the air to serve as ventilating shafts.

"The outlet structures at the surface have been so designed that a blower fan may be installed in each shaft if found necessary at any future time, the idea being to try it out first without the fans, as there seems to be a fair probability that the drafts of air caused by the four large open shafts, together with the natural circulation of air through the tunnel, will be sufficient to keep the atmosphere in the tunnel from becoming seriously contaminated."

Bankers' Opinion of the Building Situation.

Possibility that increasing prices of building materials, coupled with higher wages may curb the volume of building and construction in 1923 is expressed by *Commerce Monthly*, a magazine published by the National Bank of Commerce in New York.

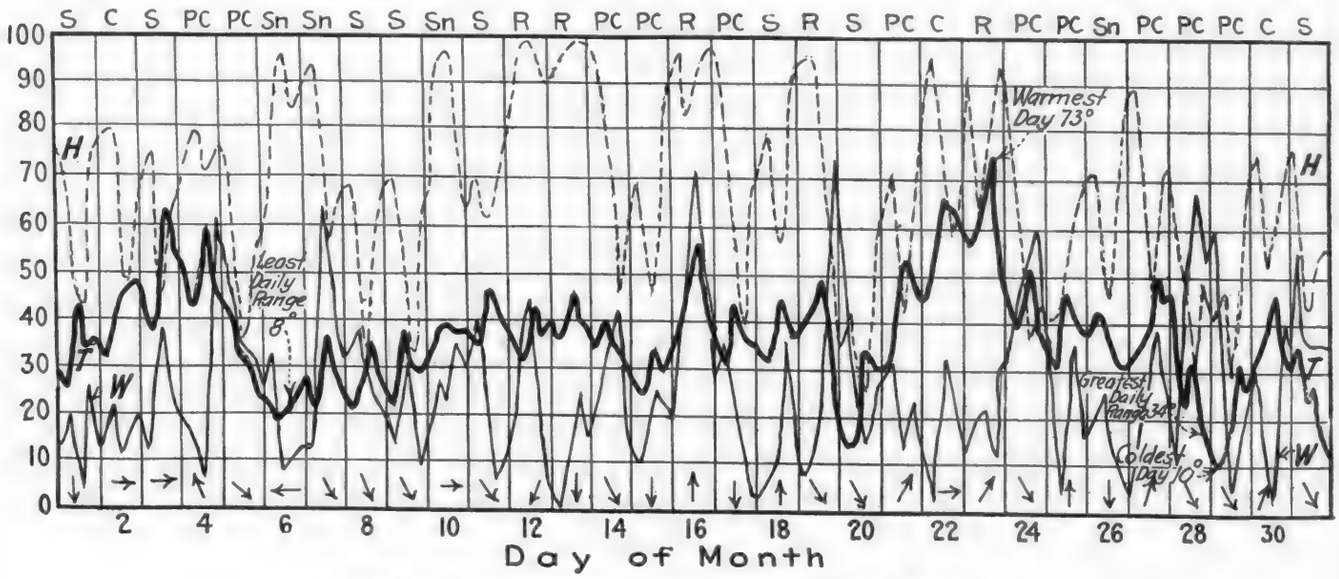
"The money value of building and construction in 1922 was the largest recorded in the building industry of the country," the article states. "The value of new contracts awarded in January exceeded that in January, 1922, or January, 1921, and predictions are being freely made that in 1923 the volume of building, on a valuation basis, will exceed even the high record of 1922.

"Whether or not these expectations will be realized," continues the article, "depends on building costs."

The article points out that rising costs may cause those who are using their own funds to delay construction and that those who plan to use borrowed funds may be hampered by unwillingness of lenders to accept current levels as a proper basis for long term loans. Fear of a shortage in building materials is dissipated to a certain extent by rising costs, but the labor shortage already is acute, the article states.

The Weather for March, 1923

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	73	67	71	65	77
Date of highest temperature	23	23	12	2	2
Lowest temperature, deg. F.	10	4	11	0	4
Date of lowest temperature	29	29	31	19	19
Greatest daily range, deg. F.	34	28	40	36	48
Date of greatest daily range	28	19	19	18	18
Least daily range, deg. F.	8	5	5	6	9
Date of least daily range	6	12.28	1	6	6
Mean temperature for month, deg. F.	37.0	33.9	38.6	33.0	41.4
Normal mean temp. for month, deg. F.	37.7	35.6	39.6	36.3	43.8
Total precipitation, in.	4.08	2.49	2.15	3.05	4.26
Total snowfall, in.	7.4	10.6	2.4	5.3	0.1
Normal precipitation for month, in.	4.10	4.08	3.01	2.55	3.43
Total wind movement, miles	16369	9310	11264	10864	11924
Prevailing wind direction	N. W.	W.	N. W.	N. W.	S.
Number of clear days	8	11	3	10	12
Number of partly cloudy days	12	10	11	8	9
Number of cloudy days	11	10	17	13	10
Number of days with precipitation	9	11	14	13	11
Number of days with snow	5	5	3	8	1
Snow on ground at end of month, in.	0	0	0	0	0


S C S PC PC Sn Sn S S Sn S R R PC PC R PC S R S PC C R PC PC Sn PC PC PC C S
Warmest Day 73°
Least Daily Range 8°
Greatest Daily Range 34°
Coldest Day 10°
H
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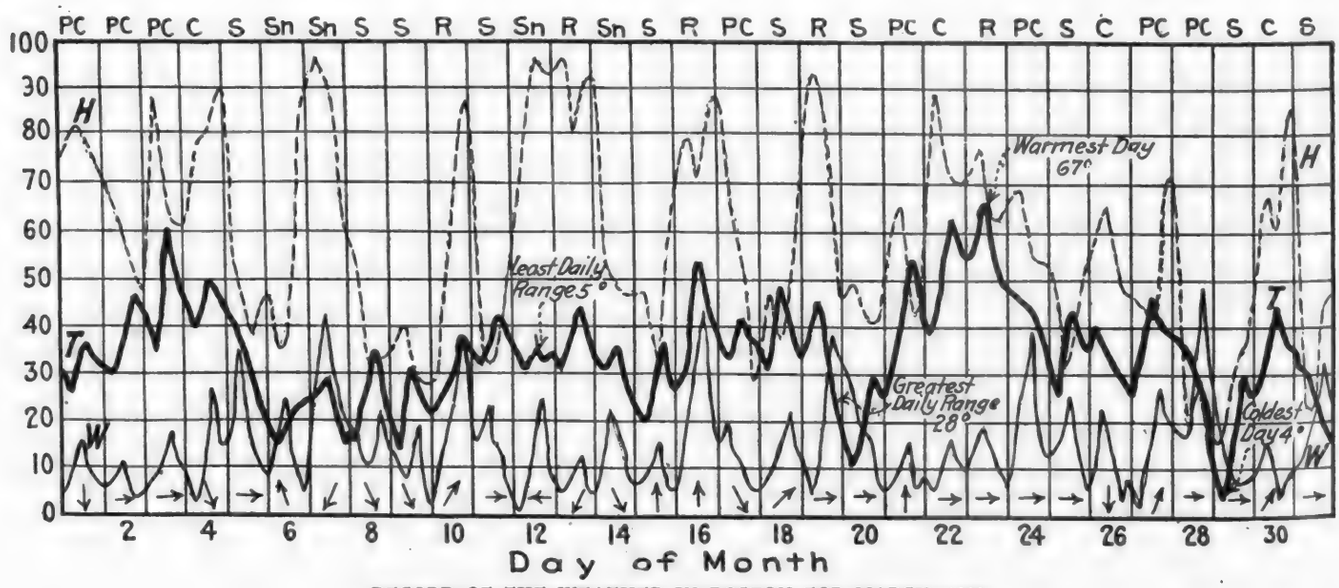
Day of Month

RECORD OF THE WEATHER IN NEW YORK CITY FOR MARCH, 1923.
(Hourly Observations of the Relative Humidity Plotted on this Chart.)


PC PC PC C S Sn Sn S S R S Sn R Sn S R PC S R S PC C R PC S C PC PC S C S
Warmest Day 67°
Least Daily Range 5°
Greatest Daily Range 28°
Coldest Day 4°
H
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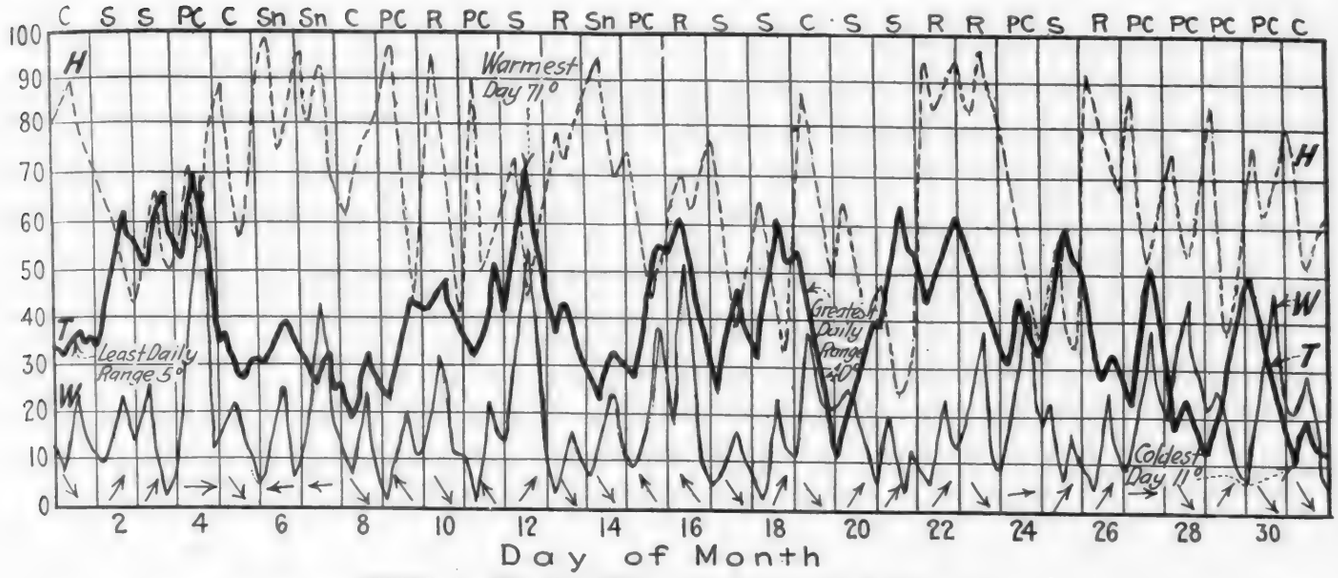
Day of Month

RECORD OF THE WEATHER IN BOSTON FOR MARCH, 1923.


C S S PC C Sn Sn C PC R PC S R Sn PC R S S C S S R R PC S R PC PC PC PC C
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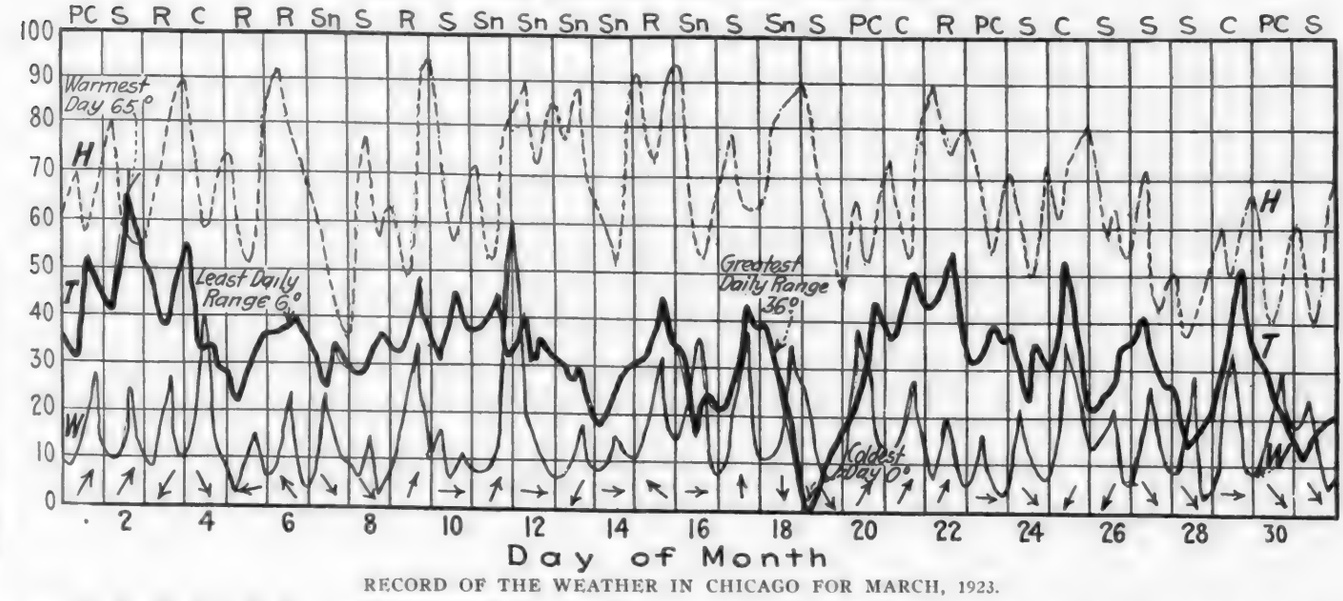
Warmest Day 71°
Least Daily Range 5°
Greatest Daily Range 40°
Coldest Day 11°
Day of Month

RECORD OF THE WEATHER IN ST. LOUIS FOR MARCH, 1923.


PC S R C R R Sn S R S Sn Sn Sn Sn R Sn S Sn S PC C R PC S C S S S C PC S
Warmest Day 65°
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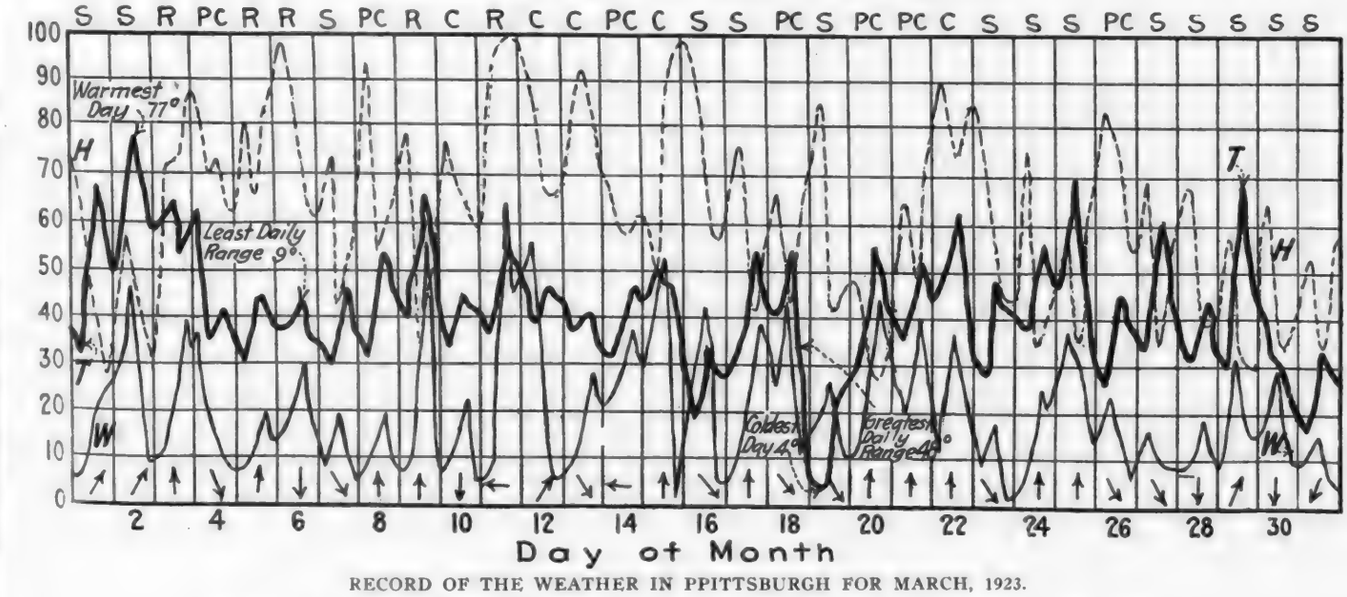
Least Daily Range 6°
Greatest Daily Range 36°
Coldest Day 0°
Day of Month

RECORD OF THE WEATHER IN CHICAGO FOR MARCH, 1923.


S S R PC R R S PC R C R C C PC C S S PC S PC PC C S S S PC S S S S S
Warmest Day 77°
H
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Least Daily Range 9°
Coldest Day 4°
Greatest Daily Range 48°
Day of Month

RECORD OF THE WEATHER IN PPITTSBURGH FOR MARCH, 1923.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A. M., 12 M., and 8 P. M.
S—Clear, P C—partly cloudy, C—cloudy, —ran, Sn—snow.
Arrows fly with prevailing directions of wind.

American Society of Heating and Ventilating Engineers

Plans for the Society's Semi-Annual Meeting.

The meeting in the same city (Chicago) at the same hotel (the Drake) and during the same week (May 21-26) of the American Society of Heating and Ventilating Engineers and of the Heating and Piping Contractors' National Association, will no doubt make this gathering one of the most representative in the history of the industry. The heating engineers will hold their sessions during the first three days of the week, May 21-23, and the remainder of the week, May 23-26, will be devoted to the heating contractors' convention.

H. M. Hart, who is general chairman of the General Committee on Arrangements for the A. S. H. & V. E. meeting, is also prominently identified with the Heating and Piping Contractors' National Association, and it is largely through his efforts that the two organizations have arranged to meet so close together.

The Drake, which is one of Chicago's new hotels is located on the Lake Shore Drive, in the northern part of the city.

Western New York Chapter Host to University of Kentucky Seniors.

With an attendance exceeding that of any previous meeting, the Western New York Chapter, at its April meeting, at the Hotel Iroquois, Buffalo, was the host to 57 men from the University of Kentucky, members of the senior class, who formed a party, under the direction of Dean F. Paul Anderson, making a tour of inspection of manufacturing and power plants. Covers were laid for 125 members and guests and a number came in later for the meeting itself.

Dean Anderson spoke on the work of the Research Laboratory of the A. S. H. & V. E., outlining the investigations made and calling attention to the valuable information already gathered.

Chairman E. E. McNair, of the society's Committee on Research, who was also present, spoke of the unique place the Research Laboratory held, declaring that the society had set the pace in this regard to every other engineering body in the country. Following his address a rally for subscriptions to the laboratory was started by Chairman W. C. Fraser of the local committee and within five minutes a total of $1,000.00 had been raised.

President W. C. Farrar then turned over the meeting to L. A. Harding, general chairman of the society's Committee on Code of Heating and Ventilating.

Mr. Harding discussed Section III of the proposed code which will be devoted to "standard method for determining outside temperatures and temperature differences for the design of heating systems."

Other speakers were F. B. Howell who discussed Section VII on minimum capacity and installation requirements for heating boilers; C. A. Booth, who spoke on Section XII, referring to minimum requirements for the design and installation of air ducts and fans; and H. Worsham, who discussed Section XIII, dealing with minimum requirements for the installation of air washers and humidifiers.

President Farrar called attention to the fact that the next meeting of the chapter would no doubt be held in the New Hotel Statler, and he urged the members to take out membership in the Buffalo Engineering Society which has its headquarters in the new hotel. These will be shared by the Western New York Chapter.

New York Chapter Discusses Return Pipe Sizes.

Three different angles of the subject of return pipe sizes were discussed by as many speakers at the April meeting of the New York Chapter, at the Building Trades Club, April 16. The first speaker, Walter S. Timmis, described standard practice in the design of return lines for one and two-pipe low-pressure steam systems, stating that the basis of the usual practice was the table originally put by A. R. Wolff for pressures ranging from 2 to 5 lbs. He then referred to the Harding and Willard, Donnelly, and Nelson S. Thompson tables as containing reliable data.

In discussing the subject generally he made the point that the return pipe must be large enough not to be affected by corrosion, so that he advocated nothing smaller than ¾-in. pipe for a branch connection or wherever the runs are horizontal.

M. G. Hook discussed the subject as applying to vapor and vacuum heating. Very little reliable data, he said, were available for this work, as those published varied by as much as 300%. He made the point that too large a return pipe will cause the water to build up during heating up conditions. At the same time the drip mains should be of a good size to take care of the boiler's priming and he recommended a minimum drip size of 1¼ in.

Mr. Hook dwelt on the importance of balancing the lines so that the first radiator to get steam would have the longest return. In this way, he said, the system would be found to heat up uniformly.

He suggested the compilation of basic standards for return pipe sizes and it was brought out that this is included in the project of the society to compile a code of heating and ventilation. Mr. Hook's suggestion was endorsed by Mr. Timmis who expressed his belief that it was quite possible to establish standard sizes of return mains.

The third speaker, Alphonse A. Adler, spoke on the theories and formulas applying to return pipe lines. Mr. Adler's discussion was in the form of a chalk talk in which he made use of the blackboard to explain the development of the fundamental formulas for water flow. James A. Donnelly, who also spoke, illustrated his points with blackboard sketches.

During the business session the result of the election of officers for the ensuing year was announced, as follows:

President, W. L. Durand; vice-president, W. J. Olvany; treasurer, F. E. W. Beebe; secretary, Edward B. Johnson. Board of governors: Alphonse A. Adler, R. H. Carpenter and George G. Schmidt.

Secretary Johnson reported the chapter membership to be 156, an increase for the year of 21 members. The report of Treasurer Beebe showed receipts for the year, including the balance on hand, of $1237 and disbursements of $673.00, leaving a balance at the end of the year of $564.00.

The meeting was then turned over to M. William Ehrlich, chairman for the evening. Mr. Ehrlich was warmly congratulated at the close of the meeting for the interesting program he had arranged. The attendance was one of the largest of the season, every seat being occupied when President Carrier called the meeting to order.

Kansas City Chapter.

A review of the Kansas City Chapter's activities to date, starting with the organization of the chapter in 1916, was the principal feature of the March meeting of the Kansas City Chapter, at the Savoy Hotel, Kansas City, March 12. The committee in charge of the meeting was composed of Messrs. Mac Intyre, Fehlig and Kitchen.

The meeting was opened by President Stackhouse, after dinner in the banquet room. It was agreed that the chapter will at some time during the year prepare papers and discuss the subject of recirculation of air in buildings, and send the papers and stenographic report of the discussions to the society's Committee on Chapters.

New members elected are Francis A. Kitchen, of J. H. Kitchen & Co.; Frank M. Hale, of the Chandler Pump & Supply Co.; and Patrick M. Hayes, of the Dempster Mill Mfg. Co., all of Kansas City.

Program for Heating Contractors' Convention.

Details of the program for the thirty-fourth annual convention of the Heat-

ing and Piping Contractors' National Association, in Chicago, May 23-26, include an address by the mayor of Chicago at the afternoon session, Wednesday, May 23. This will be followed by an address by President George M. Getschow, and there will also be an address by E. J. Cattell.

At the morning session on Thursday, May 24, the principal speaker will be Harry A. Wheeler. The report of the board of directors will be presented at this session, as well as the reports of Secretary Henry B. Gombers, the Committee on Membership (H. A. Snow, chairman); and Slogan Committee (W. H. Driscoll, chairman).

Friday morning, May 25, will be given over to reports including those of the Secretaries' Association, Committee on Apprentices (William H. Oakes, chairman); Treasurer Frank W. Howard; Auditing Committee, and Committee on Standardization (W. L. Fleisher, chairman). In the afternoon of the same day (Friday) a report on the National Trade Extension Bureau will be presented by George Mehring.

As in previous years, the meeting of the "Old Guard," composed of past presidents, will be held on the evening of the 23rd.

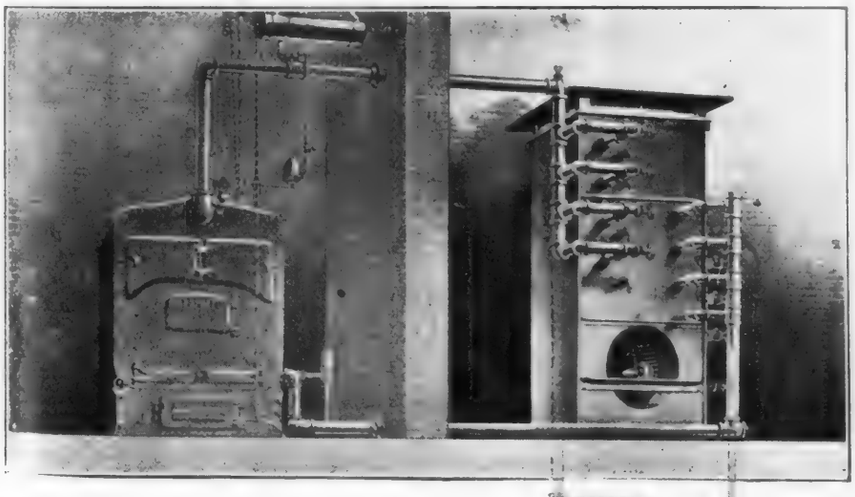
The program for the entertainment of the delegates and their guests is in the hands of a local committee.

Portable Unit Fan Blast Heaters

Previous articles in this series are: 1—*The Bactz Heater, July,* 1922; 2—*The Ilgair Unit Heater, August,* 1922; 3—*Wing-Scruplex Unit Heaters, August,* 1922; 4—*The Bayley Thermo-Units, September,* 1922; 5—*ABC Portable Heating Units, September,* 1922; 6—*Sturtevant Unit Heaters, October,* 1922; 7—*Twinvent Unit System, January,* 1923; 8—*The York Welded-Coil Unit Heater, February,* 1923.

No. 9—The Gordon Unit Heater.

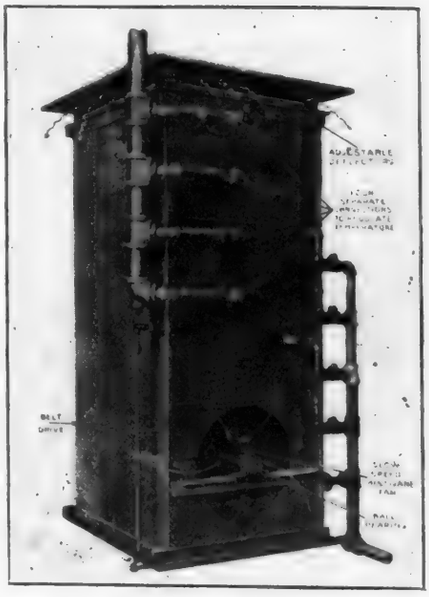
The list of portable fan blast unit heaters would not be complete without mention of the Gordon unit heater, manufactured by Robert Gordon, Inc., 622 West Monroe St., Chicago, Ill. This heater has a specially designed high-efficiency fan of the multivane type, with a cast steel spider, mounted on steel shafting. Heating coils of cast iron are used for warming the air. These coils have the same section approximately as extra heavy 1-in. pipe and are designed to carry up to 30 lbs. pressure. They are factory tested to 300 lbs. Proper pressure regulation, however, is furnished where the boiler pressures are high. Heavy-gauge sheet metal is used for the housing, braced with angles.



METHOD OF CONNECTING GORDON UNIT HEATER TO STEAM OR WATER BOILER.

As designed by the manufacturer, the Gordon unit heater is intended to be connected to a water boiler, with forced circulation assured by means of the D. & T. system. This is an integral part of the apparatus and assures temperatures at the coils closely approximating steam temperatures. This type of heating system can be filled with a non-freeze solution, instead of water, thus requiring no attention on that account in cold weather when heat is not required over shut-down periods.

The point is made that with this unit, after the building is brought up to temperature, the current for operating the fan may be shut off and the heater used as a gravity-type unit.



OPERATING FEATURES OF THE GORDON UNIT HEATER.

The heater is furnished fully equipped as shown, or it may be had without the outside manifold pipe connections. Where the boiler can be placed below the unit heater in a basement or at a sufficient drop to assure circulation, a steam-type system is the most economical to install.

The company gives a simple formula for figuring the size heater for any given requirements:

$$\text{Size of heater} = \frac{\text{B. T. U. transmission}}{0.968 \times 60} =$$

C. F. M. required for 60° temperature rise.

Handbook of Building Construction.

One of the noteworthy books of the year for the heating and ventilating engineer is Hool and Johnson's "Handibook of Building Construction." This work, in two volumes and containing no less than 1474 pages, has been compiled under the direction of George A. Hool, professor of structural engineering at the University of Wisconsin, and Nathan C. Johnson, consulting engineer, assisted by 44 specalists.

The section on heating, ventilation and power has been compiled by Ira N. Evans, who has long been a contributor to THE HEATING AND VENTILATING MAGAZINE. It takes up 100 pages of finely-set matter. This section covers vapor, steam and water heating and the data presented are either original with the author or collected by him during the course of his practice. A description is also given of the Evans "vacuo" water heating system combined with power, in which a system of vacuum control is used whereby the vacuum on a condensing turbo-generator may be varied at will from 3 lbs. back pressure to 28 in. of vacuum, independent of the power or heating loads, without stopping the machine or opening the relief valve.

In the order in which they are treated the subjects of this section are "Properties of Air, Water and Steam"; "Heating"; "Ventilation"; "Boilers, Fuels and Chimneys"; "Power"; "Pipe and Fittings."

TRADE ASSOCIATION PAMPLET, containing a classified list of trade and allied associations and publications in New York City, with appendix of governmental offices has been published by the Chamber of Commerce of the State of New York This list has been revised to April 1, 1923. The pamphet will be found a useful guide for those who are seeking trade information of various kinds or business connections in New York City. Size 5½ x 8¼ in. Pp. 44.

New Apparatus and Appliances

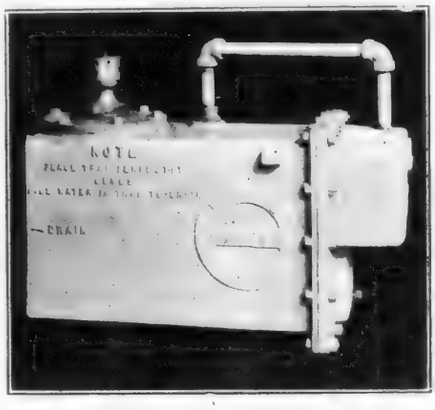
The Illinois Heat Retainor.

A device for use on vapor heating systems, which is designed to operate the system either under vacuum conditions or under open atmospheric conditions, is an interesting new appliance which has been brought out by the Illinois Engineering Co., Chicago, Ill. It is the invention of A. L. Browne, the company's New York branch manager.

During a period of twenty years or more various attempts have been made to create a device which would permit free and easy expulsion of air from a vapor heating system and prevent its return. Among the devices that have been used for this purpose may be mentioned liquid seals and check valves of standard or special design. Mercury has been used largely in liquid seal devices which, twenty years or more ago, were in general use. In principle, this device consists of a small brass pipe, one end connected to the air return piping of a vapor heating system, and the other end submerged in a bowl of mercury. A resistance or back pressure necessary to expel air through the mercury was one of the principal objections to this method.

Also small quanities of oil expelled together with the air would quickly emulsify with the mercury and the seal would become ineffective, as the mercury in an emulsified state would be drawn back into the heating system. This together with the corrosive action of mercury upon piping, caused these seals to become obsolete.

Ordinary "clapper" check valves and specially-constructed check valves having vertical seats with flat discs, or cone seats with ball checks, together with other variations, were tried next. The difficulty, however, was to prevent small particles of dirt, rust, etc., from interfering with their seating tightly and the weak closing effect, especially when a vacuum condition was forming in the heating system, had a tendency



THE ILLINOIS HEAT RETAINOR.

to make all such devices leaky. The resistance to the free and easy expulsion of air was also a point that had to be considered. It is true, however, that if such a device is kept clean, its use is quite effective.

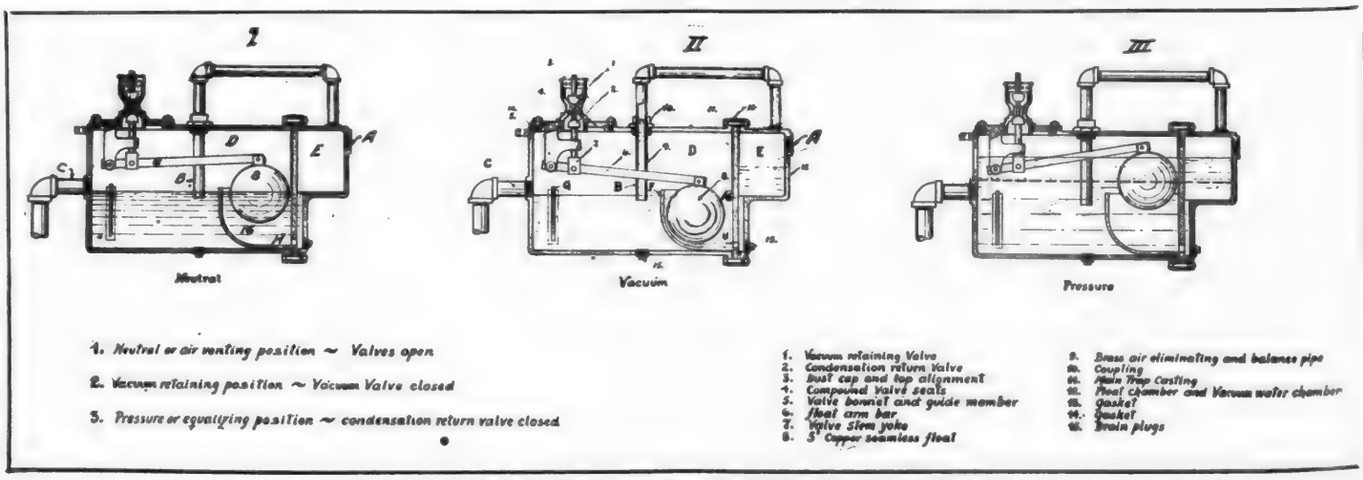
In the design of the Illinois heat retainor means are provided for the air to pass out of a heating system either in small quantities, or in volume, with no appreciable resistance, and at the same time definitely prevent its return. How this has been accomplished may be seen from the accompanying illustrations.

Fig. 1 illustrates the normally inoperative positions of the float and valve members. It will be seen that this device is divided into two general chambers. The forward chamber D is separate and distinct from the rear chamber E, excepting two conduits pipe B and port H, which are water-sealed. The valves 1 and 2 are liquid-level controlled by the rising or falling of the float. Therefore the valves are wide open when the float is in the position shown by Fig. 1.

The inlet A is connected to the horizontal portion of the dry return. The outlet C is reconnected to the return below the water-line of the boiler. As soon as the boiler drafts are opened and a very slight steam pressure started, air from the heating system passes through inlet A into chamber E, thence through pipe B, the end of which in chamber D is submerged ½-in. below the water level of chamber D. This water level is controlled by the drain or outlet C.

The air in passing through the slight water-seal from pipe B into chamber D is washed free from core sand, particles of rust, etc., which are precipitated to the bottom of chamber D. This is considered an important feature as serving to prevent dirt from interfering with the vacuum valve I. It is pointed out that the amount of resistance caused by washing the expelled air through Pipe B is so slight that it can hardly be detected by one's breath in blowing through the device. Also, with the seal fixed at ½ in., the slight resistance is constant, whether air is being expelled very slowly or in volume rapidly. Air then passes out through the wide-open valves 1 and 2 without further resistance.

Fig. 2 illustrates the vacuum or heat-retaining position of the float and valve members. When the boiler drafts are shut, or the rate of fuel combustion decreased, the steam or vapor pressure drops. When the drop is sufficient to cause the inside of the heating system to fall slightly below atmospheric pressure or, in other words, to create the


I
II
III
Neutral
Vacuum
Pressure
1. Neutral or air venting position ~ Valves open
2. Vacuum retaining position ~ Vacuum Valve closed
3. Pressure or equalizing position ~ condensation return valve closed
1. Vacuum retaining Valve
2. Condensation return Valve
3. Dust cap and top alignment
4. Compound Valve seats
5. Valve bonnet and guide member
6. Float arm bar
7. Valve Stem yoke
8. 5" Copper seamless float
9. Brass air eliminating and balance pipe
10. Coupling
11. Main Trap Casting
12. Float chamber and Vacuum water chamber
13. Gasket
14. Gasket
15. Drain plugs

CONSTRUCTION DETAILS OF THE ILLINOIS HEAT RETAINOR.

conditions of a very slight vacuum, the pull or lift caused by this vacuum from the heating system through inlet A is exerted upon the surface of the water in chamber E and the surface of the water on the inside of pipe B in chamber D.

At this point valves 1 and 2 are still open and the atmospheric pressure causes a small quantity of water in chamber D to rise in pipe B, and, at the same time, the water in the float bowl to fall and rise in chamber E through port H. As the capacity of chamber E is large in relation to that of the float bowl, a slight rise in chamber E causes a decided fall in the float bowl. As the volume of water in chamber D is great as compared with the capacity of pipe B, water rising in pipe B will cause no appreciable lowering of the water in chamber D. Therefore, the seal at this point is never broken.

In the model illustrated, when the vacuum is ½ in. or more, the water-level in pipe B is about 7 in. above that in chamber D and all water also is withdrawn from the float bowl. The head of water in chamber E to port H is then also about 7 in. The weight of the float multiplied through the actuating lever, exerts a closing pressure of over 19 lbs. per square inch, when the difference in pressure between the inside and outside of the heating system is ¼-lb. per square inch. This remarkable increase in pressure is relied upon to insure positive closing of the ground seated ball and cone vacuum valve.

As the vacuum rises or the pressure falls in the heating system the difference in pressure between chambers D and E is always equivalent to ½-in. of vacuum, represented by the hydrostatic head of 7 in. in chamber E and pipe B. This equilibrium, it is stated, is maintained as the vacuum rises through port H.

It is obvious that there is no leakage before there is ½ in. of vacuum, as the water-seals formed by pipe B and port H prevent any leakage until the water falls to the level of port H, slightly before the vacuum valve is closed with fuel pressure exerted upon it. If the drafts are again opened and pressure within the heating system again rises to atmosphere, the float and valves assume the position shown in Fig. 1.

Fig. 3 illustrates the equalizing position of float and valve members when considerable boiler pressure is carried. It will be seen how the action of the device under these conditions serves to prevent any decided drop in the water-line of the boiler. When the boiler pressure is increased condensation rising in the heat retainor through drain C causes the float to rise, as illustrated, and close the pressure valve (2). This occurs at a point several inches below the bottom of the dry horizontal returns. Further rise of condensation, together with the constant expulsion of water and air from the radiator traps, acts to quickly build up a rising pressure in the dry return system equalizing it with the rising steam pressure of the boiler.

In this manner any disastrous lowering of the water-line of the boiler is prevented.

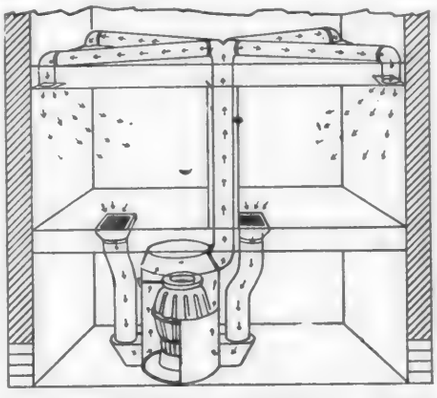
Special attention is called by the manufacturer to the fact that this equalization under pressure starts at a point considerably lower than the bottom of the dry return, at the dotted line shown. By the time it is level with the dry return complete equalization between supply and return lines is effected. As evidence of this when a radiator has been turned on, even when there are 5 lbs. or more boiler pressure, the air from it has been found to pass quickly through the return line and out of the retainor.

When the pressure drops to atmosphere, valves and float resume the position shown in Fig. 1.

An Overhead Warm-Air Furnace System.

Out of the northwest has come an idea in the form of an overhead warm-air furnace heating system which is being marketed by the Northwestern Furnace & Supply Co., of Minneapolis, Minn. It is the invention of Daniel Handelan and is known as the "Northwest Overhead" system.

As will be seen from the accompanying illustration, the arrangement con-



THE NORTHWEST "OVERHEAD" WARM-AIR HEATING SYSTEM.

sists of a main vertical stack which conveys the warm air from the furnace directly to a head in the attic. From this head one or more trunk lines are run to branches and these branches are tapped into the ceilings of the various rooms, with registers and control valves. Warm air is delivered to the rooms through registers in the ceiling, instead of through floor or baseboard registers, as in ordinary furnace plants.

By conveying the heated air through one main vertical stack in the attic, a rapid flow of air is secured, and it is stated this velocity enables the overhead system to satisfactorily conduct heated air 165 ft. away from the main stack, while in ordinary basement systems, warm-air pipes 15 to 20 ft. long are an exception on account of the difficulty of getting a good circulation.

This company is also the manufacturer of the Northwest warm-air furnace which has several unique features, including a humidifier in the shape of a ring-shaped receptacle located on top of the fire dome, automatically supplied with water from a float-controlled water tank. This humidifier, it is stated, has an evaporation capacity of 48 quarts in 24 hours.

HUMIDIFIER USED WITH NORTHWEST WARM-AIR FURNACE.

A Recent Development in Warm-Air Furnace Humidifiers.

Among the recently-developed types of humidifiers for use in connection with warm-air furnaces, that designed by Jesse M. McHenry of St. Louis and adopted by the Bridge & Beach Mfg. Company, of that city, has some points of special interest. In this device, for instance, the control of the amount of humidity is accomplished by increasing or decreasing the surface area of the water exposed to the air, from which surface evaporation takes place. The vapor pans are made narrow at the bottom and comparatively wide at the top, so as to provide for the maximum evaporation when the pans are filled and the minimum when the water is carried very low. Any degree of evaporation between the maximum and

BRIDGE-BEACH HUMIDIFIER FOR WARM-AIR FURNACE.

minimum can be had by adjusting the open end of the vacuum pipe which hangs into the auxiliary tank outside of the casing.

By moving the ratchet which engages the flexible tube attached to the end of this pipe the opening in it is raised or lowered according to the desires of the operator. The moment the water rises sufficiently to seal the opening in this tube, the air ceases to flow through the tank and a vacuum is soon formed. Under this condition the water which discharges from the tank to the auxiliary receptacle, ceases to flow.

It is figured that the tank will be filled once a day. This is accomplished by opening the globe valve shown at the top of the tank. The valve, of course, has to be tightly closed when the tank is filled so as to make it possible to establish a vacuum in the top of the tank during the operation and during the control of the discharge of water from the tank to the auxiliary receiving pan.

This humidifier is made and sold as being capable of supplying a gallon of water per day for each room.

The Litt Fireplace Heater.

With all the developments of the past years, we have never gotten away from the inherent, permanent charm of the family hearth. It is true that we have improved greatly upon the past in the heating and the ventilating of the small house, but for a sense of cheer and comfort there has been found no substitute for the open fireplace.

The invention here described relates particularly to a heating apparatus for

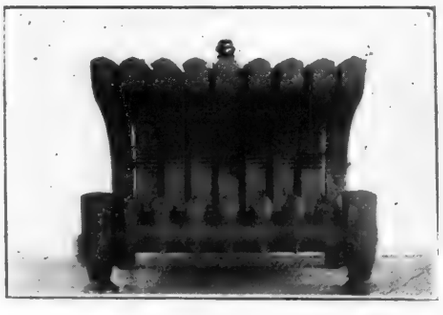


FIG. 1.—LITT FIREPLACE HEATER.

radiating and heating purposes, which may be easily installed in open fireplaces, without sacrificing any of the desirable features of a fireplace. It is in the form of a combined sectional boiler, constructed identically in the same manner as a cast-iron radiator, with left and right-threaded nipples or push-nipple connections. The complete unit constitutes a firebox, grate, andirons and radiator. It serves to distribute heat to the room in which it is placed and also develops enough heat units to warm additional rooms, by means either of a hot water or steam system.

Fig. 1 shows a front elevation of a nine-section heater and its similarity in construction to a hot water or steam radiator. The riser tapping, in this illustration, is not shown in the center section, but is interchangeable. All connections provide for S. A. E. standards.

Fig. 2 represents a side view, showing how advantageously the sections are formed to obtain a greater concentrated heating surface. The side grates, shown in this view, are to be removed when wood is the fuel. When coal is used, or coke, peat or briquettes, the side

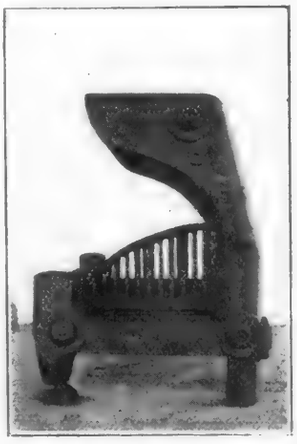


FIG. 2.—SIDE VIEW OF LITT FIREPLACE HEATER.

grates may be adjusted to make the firebox capacity conform to the different sizes of fuel.

The rear and bottom view, illustrated in Fig. 3, show how the heater is water-jacketed throughout, in order to utilize to the fullest extent the heat given off by the hot ashes which fall through the grate.

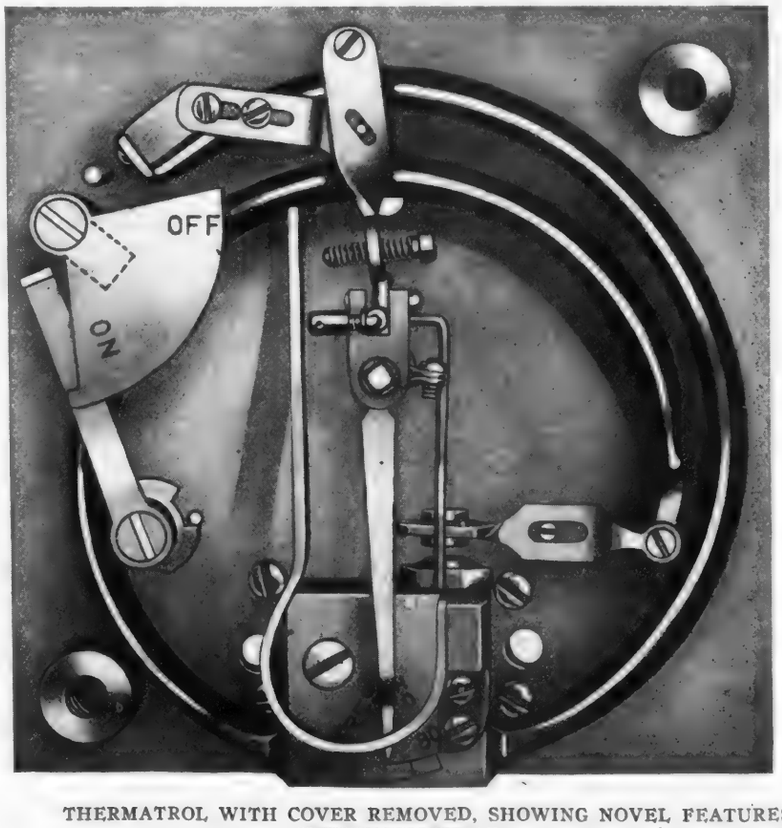
FIG. 3.—REAR AND BOTTOM VIEW OF LITT HEATER.

The Litt heater has three adjustable and removable grates. The center grate forms the bottom of the firebox, with enough play to permit the ashes to be shaken down. The side grates have already been described.

The Litt fireplace heater, which has been developed by Harry Litt, is now being marketed by the Litt Fireplace Heater, Inc., Great Neck, Long Island, N. Y. It is made in any required number of sections.

A Thermostat with Novel Features.

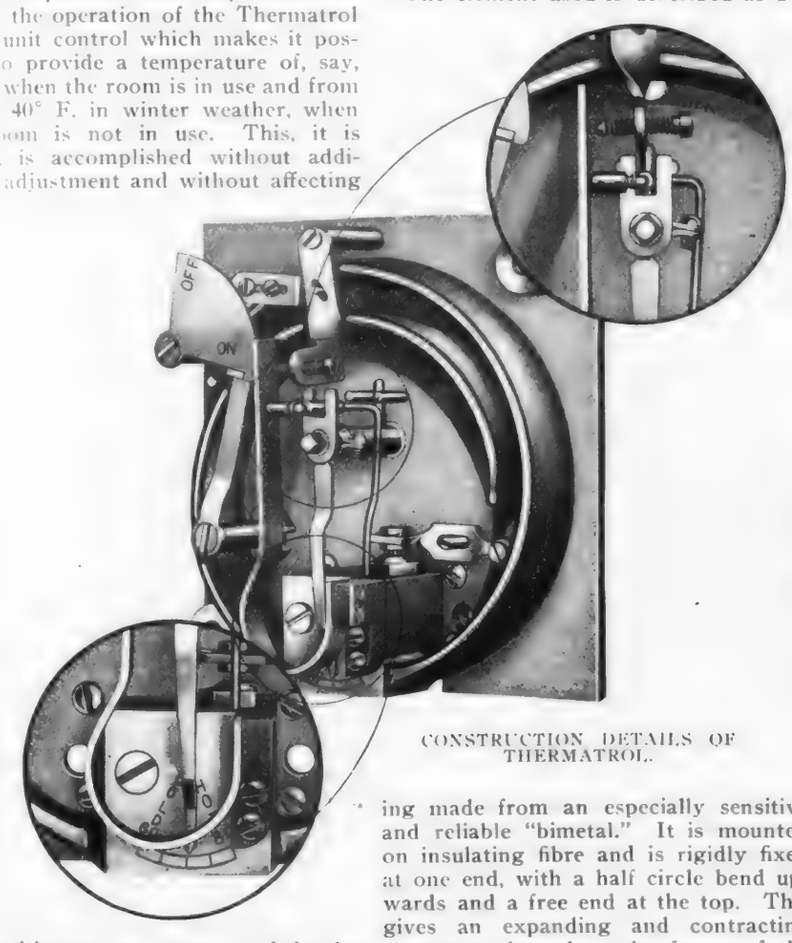
A thermostat operating on a central compressed air system but which provides automatic heat control for each room, has been brought out by the Heat Control Service Corporation, Brooklyn, N. Y., under the name of Thermatrol. This device is being used in a number of school buildings in New York in which it is desired to heat some of the rooms during the evenings without going to the trouble of manipulating the thermostats.



THERMATROL WITH COVER REMOVED, SHOWING NOVEL FEATURES OF NEW THERMOSTAT.

The principal features of construction of the Thermatrol are shown in the accompanying illustration. It is made entirely of metal without springs or delicate mechanism. It operates in connection with a diaphragm supply valve on each radiator to be controlled, or diaphragm motor-controlling dampers on heat ducts. An air compressor and tank furnishes the motive power.

The unique and most important feature in the operation of the Thermatrol is the unit control which makes it possible to provide a temperature of, say, 70° F. when the room is in use and from 35° to 40° F. in winter weather, when the room is not in use. This, it is stated, is accomplished without additional adjustment and without affecting



CONSTRUCTION DETAILS OF THERMATROL.

the sensitiveness or accuracy of the device. With this control, it is possible to shut off the heat in any room automatically and at the same time keep on the heat in the other rooms in the building.

Mounted on each Thermatrol is a Bourdon tube directly connected with the air-pressure system, so that the tube is directly affected by an increase or decrease in air pressure. During the day an air pressure of 15 lbs. is carried on the system. At night a pressure of 10 lbs. is carried, causing the Bourdon tube to contract and close the diaphragm valve so that no steam enters the radiator until a temperature of 35°-40° is reached, when the Thermatrol is designed to again function.

If heat should be required in the room at night, the indicator on the Thermatrol is moved to the "on" position which causes the instrument to function at the temperature at which it is set. This indicator will automatically return to the "off" position when the air pressure is again raised to 15 lbs.

The Thermatrol is made of metal built on a foundation of brass plate 3¾ in. square or 4 in. round. Two lugs are on the bottom side of the block to which the frame is secured. Two Bourdon tubes are fastened to this frame. One tube operates the air valve and the other operates the heat control to prevent the room temperature from dropping below 35°. These Bourdon tubes are similar to those used in high-pressure gauges, and are tested to 60 lbs. pressure.

The element used is described as being made from an especially sensitive and reliable "bimetal." It is mounted on insulating fibre and is rigidly fixed at one end, with a half circle bend upwards and a free end at the top. This gives an expanding and contracting movement lateral to the frame of the instrument.

Adjustment of the Thermatrol for a higher or lower degree of heat control is made by positioning a movable "bubble or leak" port. When this port is set at the desired point, indicated by a dial in front of the block, the expansion or contraction of the element acts to open or close the port, as the case may be. Emphasis is laid by the manufacturer on the fact that no adjustment is made on the element of the Thermatrol.

The "bubble or leak" port is designed so that when an increase or decrease of temperature is required, the positioning of the port, which can be moved to or from the element, will give the desired results at the temperature at which the instrument is set to function, as indicated by the dial. The seat of this port is covered by a disc, mounted on the "bubble" port, so as to insure the proper seating of the disc, no matter how the port is positioned. The movement of the air valve is slight. It is directly connected to the Bourdon tube which prevents it from becoming clogged, stuck or from hanging open.

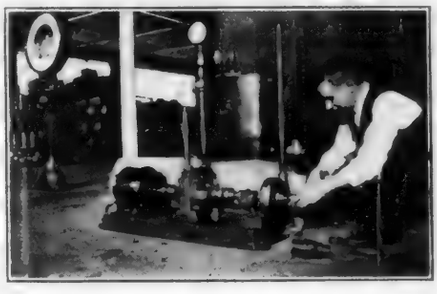
The company also markets the Humitrol, an automatic moisture regulator, which operates on the same principle as the Thermatrol, except that the bimetal element is replaced with a specially prepared piece of hard maple which is sensitive to humidity changes.

The vice-president and general manager of the company is Alexander D. Simpson, who recently resigned his position with the New York City Board of Education after a service of eighteen years. From 1905 to 1908 he served as special inspector of all mechanical equipment and since 1908 has been in charge of the heating and ventilating division of the board for the Borough of Brooklyn.

The Heat Control Service Corporation, which is marketing the new thermostat and humidostat, is capitalized at $300,000.

An Advance View of the New Trane Vacuum Pump.

The accompanying photograph shows Engineer R. H. Anderegg, of the Trane



R. H. ANDEREGG INSPECTING NEW TRANE VACUUM PUMP.

Co., La Crosse, Wis., in action. The pump he is studying with such good-natured diligence is the new Trane vacuum unit which is soon to be placed on the market.

New Device Prevents Losing Recording Button.

An improvement recently made in the button which holds the chart on recording thermometers and gauges will be welcomed by users of those instruments. Not only does this do away

DEVICE TO PREVENT LOSS OF BUTTON ON RECORDING INSTRUMENTS.

with the trouble of unscrewing and removing the button and then replacing it every time a new chart is to be put on the instrument, but it eliminates all possibility of losing the button.

On the recorders now being placed on the market by the Schaeffer & Budenberg Mfg. Co., and the American Steam Gauge and Valve Co., Division of Brooklyn, N. Y., there is an ingenious patented chart holder which cannot be removed.

A quarter-turn draws in the little metal clips, or fingers, and permits the chart to be removed. Another slight turn in the opposite direction pushes out the clips again and they grip the new chart firmly.

New Trade Publications

SYLPHON DAMPER REGULATORS, steam, hot water and vapor types manufactured by the Fulton Co., Knoxville, Tenn., are the subject of a well-illustrated folder. The illustrations and text are prepared with the idea of conveying the message to the owner or builder and thus pave the way for the sale of Sylphon regulators through regular and jobbing channels. Stress has been laid on the desirability of evenly heated homes, even temperature hot water, and what you should look for in a regulator to obtain these results. In reviewing the development of this regulator, the folder tells how the Fulton Company was the first to introduce and employ an all-metal seamless diaphragm in regulators for controlling draft dampers on heating boilers. This was something over sixteen years ago. Since the Sylphon damper regulators have become widely known and used, the statement being made that at the present time there are more than twenty manufacturers of boilers using Sylphon damper regulators as standard equipment. Attention is also directed by the manufacturer to the ease with which Sylphon steam and hot water regulators may be adapted to any type of boiler or heating system, new or old. A supply of the folders with the individual name and address of the distributor, is being furnished to interested firms in the supply trade.

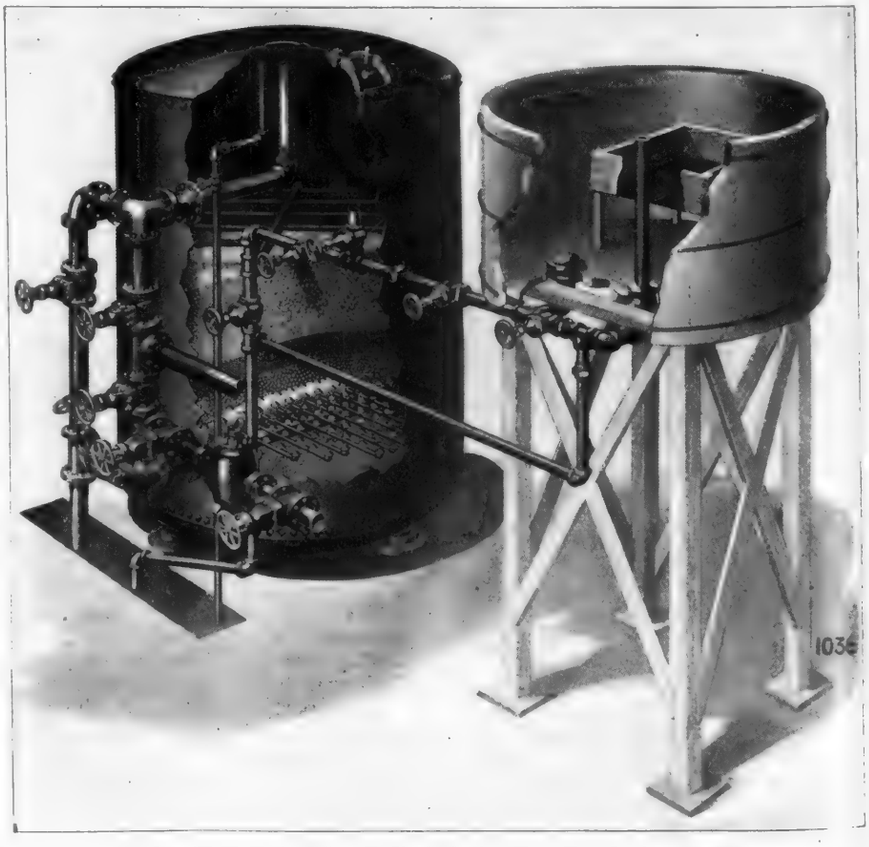
WEATHER VEIN, Vol. 3, No. 2, issued by the Carrier Engineering Corporation, Newark, N. J., contains, among other things, an article on "The Laboratories of the Nation," with particular reference to the United States Bureau of Standards. This will be read with special interest by those who attended the recent annual meeting of the American Society of Heating and Ventilating Engineers in Washington. Among the illustrations accompanying the article are views of the testing apparatus for determining the shrinkage and expansion of cotton blankets under given tension at given relative humidities, and of the Carrier equipment which conditions the air in the textile-paper laboratory of the bureau. Still another view shows the refrigerating machine which supplies the Carrier equipment. A chart from the recording instrument connected with the equipment shows the uniform temperature and relative humidity maintained in this section of the bureau.

HOLMBERG HEATING SPECIALTIES, manufactured by the Holmberg Steam Trap Co., Lindborg, Kan., are presented in a new catalogue featuring the Holmberg quick-vent air and vacuum valve, vacuum vapor vent, vacuum vapor steam trap and eliminator, and vacuum seal, all of which were designed by John A. Holmberg. Typical installations are also shown of a pressure-vacuum-vapor sub-drain system and a pressure-vacuum-vapor gravity system using these specialties, together with numerous piping details.

GRAVER ZEOLITE WATER SOFTENERS, designed to provide water without hardness for any purpose, are illustrated and described in a bulletin (No. 509) issued by the Graver Corporation, East Chicago, Ind. Zeolite, it is explained, is the geological name of a mineral that is a hydrated silicate of aluminum, combined with an alkali, or an alkaline metal, or both. It is the property which this mineral possesses for exchanging its base for another base that has led to its employment in the field of water softening. After discussing the chemistry of Zeolite water softening, the bulletin takes up the operation of the Graver Zeolite softener which consists of essentially two parts—the softener itself, which is a steel shell acting as a container for the zeolite mineral, and a salt-regenerating solution tank. Size 8½ x 11 in. (punched for binding).

BEHRER & CO., New York, dealers in steel and wrought-iron pipe, boiler tubes, steam fittings and valves, iron and brass, together with other products used in the heating and plumbing industries celebrates its 25th anniversary in a special catalogue, describing the company's rise from its modest beginning in 1897. The president of the company is Martin Behrer, who has been identified with the heating and plumbing industries since 1884 and who has been the guiding spirit of the firm of Behrer & Company since its inception.

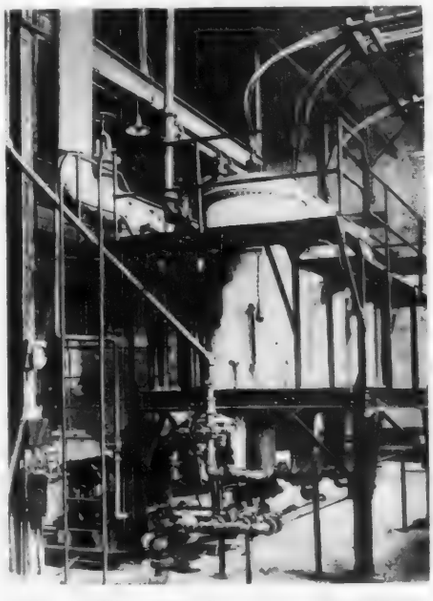
VALVE WORLD for April, 1923, the monthly periodical of Crane Co., Chicago, contains the fourth issue of the Crane Business Survey, giving the business conditions as of March 27 throughout the country as reported by its various branches and offices. Considering the country as a whole, the Survey reports business in virtually all lines to be good and the volume increasing. Commodity prices are advancing. Building is especially active, the permits indicating that 1923 will be a record year. In the issue itself the articles include one on the Institute of Technology and Normal School, in Calgary, Canada, which is



CONSTRUCTION OF GRAVER ZEOLITE WATER SOFTENER.

described as a fine example of what the Provincial Government of Alberta is doing in the line of public education.

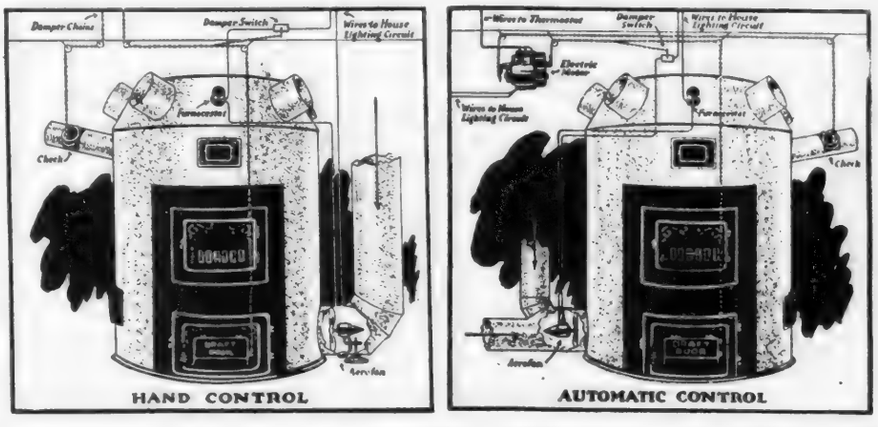
"ELECTRO" STEAM BOILERS, an apparatus for generating steam in any required quantity at any specified pressure by means of alternating current which is led directly into the water to be evaporated, are brought to the attention of the industry in a new catalogue published by the manufacturer, the Electro Furnace Construction Co., 908 Chestnut St., Philadelphia, Pa. The "Electro" steam boiler, an illustration of which appeared in THE HEATING AND VENTILATING MAGAZINE for June, 1922, is the result of several years' tests and experiments by F. T. Kaelin, chief engineer of the Shawinigan Water & Power Co., Canada, and has been developed in the United States by the Electric Furnace & Construction Company. Steam is generated in this apparatus by the passage of high-voltage alternating current between specially designed electrodes immersed in water. The resistance of the water to the passage of this current converts it into steam with what is characterized as almost unbelievable rapidity, so that



20,000 K. W. (2,000 B. H. P.) "ELECTRO" STEAM BOILER AT BELGIAN INDUSTRIAL CO., LTD., QUEBEC. POWER SUPPLY—6600 VOLTS, 3 PHASE. PRESSURE—135 LBS.

saturated steam at any pressure can be delivered from a boiler occupying only a fraction of the space required by a fuel-burning boiler of the same steam-producing capacity. Its average thermal efficiency is given as from 98 per cent. to 99 per cent. The most important application of the "Electro" steam boiler, it is stated, will be found in industries located within the range of hydro-electric power plants where use may be made of surplus energy or water running to waste. Among the users of the heaters are mentioned central heating plants and hydro-electric power plants. The heater is made in many sizes with capacities ranging from 2 K. W. (6 lbs. steam per hour) to 35,000 K.W. (105,000 lbs. steam per hour). Voltage ranges from 110 volts to 22,000 volts, and pressures from atmospheric to 250 lbs. gauge. A number of typical installations are shown in the catalogue. Size 7¾ x 10¼ in. Pp. 12.

HONEYWELL FURNACESTAT, for accelerating the air flow in warm-air furnace ducts, is an interesting product of the Honeywell Heating Specialties Co., Wabash, Ind., which is described in newly issued circulars. The Furnacestat and fan may be installed with or without a room temperature regulator. The device is described as not a blast, but a boost, as the moment created by the two-speed fan is not unduly rapid. The Furnacestat is installed with the sensitive element projecting through the casing of the furnace into the warm-air chamber. Expanding or contracting with variations of temperature, this sensitive element actuates a snap switch located in the head of the device which stands out from the furnace to allow clearance for the wiring. This switch connects with the fan which stops and starts in direct response to change in temperature. In the fan circuit a switch is placed and connected with the chain that opens and closes the draft damper. The fan motor is but 4 in. in its widest diameter, so as to interfere as little as possible with the natural circulation of the air.



TYPICAL INSTALLATIONS OF HONEYWELL FURNACESTAT, FOR EITHER HAND OR AUTOMATIC CONTROL.

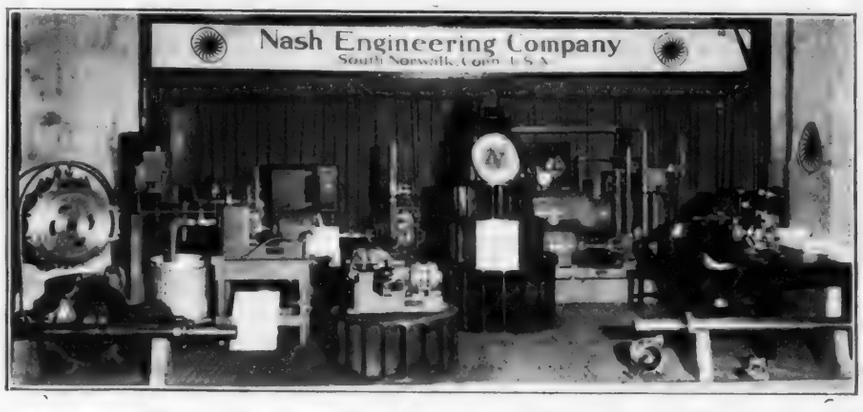
LOW-PRESSURE STEAM FOR PROCESS PURPOSES supplied from a turbine of special design, is the subject of a profusely illustrated pamphlet issued by the De Laval Steam Turbine Co., Trenton, N. J. This turbine operates automatically either as a straight condensing turbine, as a back-pressure turbine, as a bleeder turbine, or as a mixed-flow turbine or as a low-pressure turbine, in such a manner as to maintain a balance between power requirements, low-pressure steam requirements, hot water requirements, and the amount of power available from water power. This is accomplished by a third pressure-controlled valve, in addition to the high-pressure and low-pressure valves ordinarily controlled by the steam governor in a mixed flow turbine.

NEW WESTINGHOUSE PUBLICATIONS include the following: 1161-A—Large Squirrel-Cage Induction Motors; 3400—Type F-10 Oil Circuit-Breakers; 1611—Type AF Automatic Auto-Starter for Polyphase Squirrel-Cage Induction Motors; 2390-A—Type E Engine-Driven Alternating Current Generators; and 3499-A—Type CS Control Switches.

National Better Homes Week

National Better Homes Week, June 4 to 10 will be observed in more than 1,000 cities and communities, according to reports received by the American Homes Bureau. Last year there were exhibits in 961 communities.

In a majority of the cities where the



NASH ENGINEERING COMPANY'S EXHIBIT AT PAPER INDUSTRIES EXPOSITION, GRAND CENTRAL PALACE, NEW YORK

week will be observed arrangements are being made to hold demonstrations of model homes, including exhibits on heating and ventilating equipment, plumbing, lighting, decorating, and furnishngs. These exhibits will be offered by manufacturers and by local dealers in the various products which go to make up a complete and modern home.

The annual observation of National Better Homes week bears the indorsement of President Harding, leading educators, women's clubs, and has the active support of Secretary of Commerce Herbert Hoover.

In many communities special newspaper advertising campaigns are being conducted already or being planned for the week preceding the celebration. Dealers cooperating in the observation have been urged to lay emphasis in their advertising and in their demonstrations on quality rather than price.

Business Cycles and Unemployment

Recommendations of the Committee of the President's Conference on Unemployment

Definite recommendations to prevent a recurrence of the condition of unemployment and to stabilize business and industry are contained in the report, now published, of the President's Conference on Unemployment which met at Washington, D. C., in September, 1921, under the chairmanship of Secretary of Commerce Hoover.

After taking steps to relieve the emergency situation, a sub-committee, it will be recalled, was named to study the whole structure of business, to analyze the so-called business cycles and their relation to unemployment.

In a foreword to the committee's report Mr. Hoover says:

"Broadly, the business cycle is a constant recurrence of irregularly separated booms and slumps. The general conclusion of the committee is that slumps are in the main due to the wastes, extravagance, speculation, inflation, over-expansion, and inefficiency in production developed during the booms; the strategic point of attack, therefore, is the reduction of these evils mainly through the provision for such current economic information as will show the signs of danger and its more general understanding and use by producers, distributors, and banks, inducing more constructive and safer policies.

"The report does not suggest panaceas or economic revolution but seeks to drive home the facts that the enlargement of judgment in the individual business men as to the trend of business and consequent widened vision as to approaching dangers will greatly contribute to stability and that the necessary information upon which such judgment can be based must be systematically recruited and distributed."

The committee reported that any consideration of methods to control the business cycle naturally divided itself into two parts—first, methods of preventing excessive expansion and second, methods of reducing the extent of the decline and alleviating the distress caused by depression.

DEFINITE RECOMMENDATIONS FORMULATED BY THE COMMITTEE.

Among the remedies discussed by the committee were: control of credit expansion by banks; possible control of inflation by the Federal Reserve system; control by individual business men of the expansion by banks; possible control of inflation public and private construction, including construction by public utilities, at or near the peak of the business cycle; construction of public works in the depression; unemployment reserve funds; and federal and state employment bureaus.

The first recommendation concerned the collection of fundamental data bearing upon trends of business and the Department of Commerce already has established a monthly survey of current business, which summarizes the data available from all sources.

It was found that there is great need for expanding and standardizing the statistics now collected by State and federal bureaus and this was recommended, together with publication of unemployment statistics by the Federal Bureau of Labor statistics, and the final summation of all of this information by the Department of Commerce.

The committee recommended wider cooperation on the part of all industries. It declared also that collection and dissemination of statistics be current, periodic and in comparable form for many industries.

While expressing the belief that forecasting of probable business trends should not be undertaken by the government except in a limited field, the committee urged that research work be carried on continuously by the government bureaus because the data available to such bureaus are more extensive than those available to other institutions.

Another important recommendation for control of business cycles was that individual bankers be asked to assume a larger measure of responsibilty. It was suggested that when prices are rising and business is expanding that bankers ask borrowers to maintain an increasing ratio of quick assets to current liabilities.

Declaring that a close parallel is usually observable between the cycle of business and the cycle of credit, the committee suggests the possible control of inflation by the Federal Reserve system. One specific suggestion in this respect is that the Federal Reserve system which now holds, as a result of the World War, a much larger supply of gold than would suffice to support all the credit which American industry and credit can possibly need under present price levels, set aside, if possible, a special reserve against future foreign demands that portion of their gold holdings which is considered by them now in excess of the proportion of the world's gold which this country should normally be expected to hold.

The committee expresses the belief that while the individual cannot in any large way influence the general situation or entirely avoid the losses incurred in periods of depression he can, in most cases, by foresight keep his business fudamentally sound. Planning production in advance and with reference to the business cycle, laying out extensions of plant and equipment ahead of immediate needs with the idea of carrying them through in periods of depression, and the accumulation of financial reserves in time of prosperity are suggestions which the committee feels may help control the general situation by individual businesses.

POSTPONING GOVERNMENT CONSTRUCTION WORK DURING BOOM PERIODS.

An important recommendation which just now is the subject of intense argument, is that periods of expansion might in part be controlled by cessation and postponement of construction by the government, railroads, public utilities and private owners in boom periods when prices are high.

While recognizing that there are fundamental difficulties to such a program the committee strongly urges the plan and points out that construction during periods of depression, when costs are lower, is economical.

Nothing is more demoralizing for wage earners than the feeling of insecurity of employment, the reports states, in urging that some plan be worked out for the accumulation of unemployment reserve funds. Because of inadequate statistics on the subject the committee found itself unable to make a definite recommendation along this subject, but suggests that the matter be given further study and that wage earners and employers might well contribute during periods of employment to a reserve fund under separate or joint control to help sustain the worker when unemployed in periods of depression.

Establishment of a national system of employment bureaus is the final recommendation of the committee. "We do not believe," the report says, "that if such employment bureaus are organized throughout the country they will have a direct effect on the business cycle, but we do believe their reports will show the demand for labor and the number of workers seeking positions and will therefore be another measure of business conditions."

The committee's personnel was: Owen D. Young, chairman; Clarence M. Woolley, president of the American Radiator Company; Joseph H. Defrees, Matthew Woll, Mary Van Kleeck, and Edward Eyre Hunt, secretary.

Japanese Heating Men Get Together.

Through the courtesy of one of our readers in Japan, Genzo Fujimura, of Tokio, we are able to present the accompanying photograph of a group of heating and plumbing engineers and manufacturers who held a joint meet-

ing at the Insurance Club in Marunouchi, the business center of Tokio, last December.

After partaking of a fine French dinner, several hours were devoted to discussions regarding an educational campaign covering the field of heating and plumbing, and in the exchange of ideas concerning heating and plumbing installations and appliances.

GATHERING OF JAPANESE HEATING AND PLUMBING MEN IN TOKIO, JAPAN.

Such meetings, writes our correspondent, are held four or five times a year and he adds that the men shown in the accompanying photograph do not represent, by any means, all of those engaged in this profession and business in Tokio.

"The chairman of the meeting," concludes our correspondent, "expressed his desire that this picture be printed in your valuable magazine and I would appreciate your courtesy if you could spare space for it."

Death of William A. Burnham.

William A. Burnham, president of the Lord & Burnham Co., Irvington, N. Y., and of the Burnham Boiler Corporation, Elizabeth, N. J., died suddenly at his home in Irvington, April 19. He was 77 years old. While Mr. Burnham's activities had been connected mostly with the development of greenhouses and greenhouse equipment the growth of the company's boiler department led eventually to the formation of a separate organization to handle the company's line of heating boilers for use generally in all types of buildings.

Mr. Burnham was also prominent as a banker and at the time of his death was a director of the Irvington National Bank, the Westchester Savings Bank and the Tarrytown National Bank.

Death of President of Engineering Institute of Canada.

Shortly after publishing the announcement in our April issue of the election of Arthur T. St. Laurent as president of the Engineering Institute of Canada, news was received of his death in Ottawa. Mr. St. Laurent had been in poor health for some time but his death was entirely unexpected. Mr. St. Laurent was chief engineer of the Department of Public Works. Many of the leading officials of the department, as well as councillors of the Engineering Institute of Canada attended his funeral.

Walter J. Francis, as senior vice-president of the Institute, was called upon to assume the office of president for the remainder of the presidential year. Mr. Francis is the senior partner of the firm of Walter J. Francis & Company, of Montreal, his associate being Frederick B. Brown. This firm has had an active career, having designed and reported on numerous hydro-electric and steam power plants. A year ago, when the Royal Commission was appointed by the provincial government of Ontario to make a complete report on the activities of the Hydro-Electric Power Commission of Ontario, Mr. Francis was appointed consulting engineer to the commission and this work has occupied much of his time during that period. He is a graduate of the University of Toronto.

JOHN W. KENNY, for many years connected wth the John Simmons Co., New York, in various capacities, died April 2. He was 77 years old. Mr. Kenny entered the employ of the John Simmons Company in 1883 and was for a number of years in charge of the company's nipple shop. Upon the death of James Hepburn, in 1902, Mr. Kenny was made superintendent of the shop and pipe cutting department, which responsible position he held up to the time of his death. One of the most important of Mr. Kenny's activities for the company was the introduction of steel pile casing for foundation work. He had made such a name and place for himself that his loss will be keenly felt by his friends and associates in the trade. He was a member of Scotia Lodge, F. and A. M. and Brooklyn Council No. 72, Royal Arcanum.

EDWARD H. DEAN, president of the Dean Bros. Steam Pump Works, Indianapolis, Ind., died suddenly at his home in Indianapolis, March 11. He was 80 years old. Mr. Dean began his business career as a machinist and during the Civil War served in the navy as engineer.

While on duty on the flagship Minnesota he took part in the bombardment of Fort Fisher. He served afterwards on one of the Ericsson monitors. After the war Mr. Dean entered the foundry and machine business in Rome, N. Y. In 1870 the business was moved to Indianapolis as the Dean Bros. Steam Pump Works with Mr. Dean as president. He remained president of the company from that time until his death.

GEORGE H. GRAVES, a former treasurer and director of the Walworth Mfg. Co., Boston, Mass., and who had been connected with the company for fifty years, died in Malden, Mass., March 23. He was 79 years old. At the time Mr. Graves went with the company it was known as the J. J. Walworth Company. His service as treasurer extended from 1865 to 1886. He retired from business four years ago.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE published monthly at Cooperstown, N. Y., for April 1, 1923.

State of New York, County of New York, ss:

Before me, a notary public in and for the State aforesaid, personally appeared Arthur S. Armagnac, who, having been duly sworn, according to law, deposes and says that he is the editor of The Heating and Ventilating Magazine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443 Postal Laws and Regulations printed on the reverse of this form to wit:

1. That the names and addresses of the publishers, editor, managing editor, and business managers are:

Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Editor, Arthur S. Armagnac, 1123 Broadway, New York, N. Y.

Managing Editor, None.

Business Manager: Gustave Petersen, 1123 Broadway, New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or if a corporation, give its name and the name and address of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Arthur S. Armagnac, 1123 Broadway, New York.

Gustave Petersen, 1123 Broadway, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above giving the names of the owners, stockholders, and security holders, if any, contain, not only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stock holders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than that of a bona-fide owner and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

ARTHUR S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 17th day of April, 1923.

A. L. Scantlebury.

Notary Public Kings County No. 631.

Certificate filed in New York.

County Clerk's No. 455.

New York County Registers No. 5479.

(My term expires March 30th, 1925.)

National Prosperity Increases

Wage Increases Provided For in Part by Manufacturing Economies—Consumer Comes to Aid of Retail Dealer

Especially prepared for The Heating and Ventilating Magazine.

BY L. W. ALWYN-SCHMIDT

Economic prosperity, when it finally arrives, does not strike each branch of the national industry at one and the same time. It is heralded first in the basic industries, gaining strength slowly and picking up the threads of the market as it proceeds. As the result we have today the not exceptional situation of a very pronounced recovery in most principal industries, while certain supplementary industries are still comparatively quiet. Recovery in these is bound to come with the beginning of their annual seasonal activity.

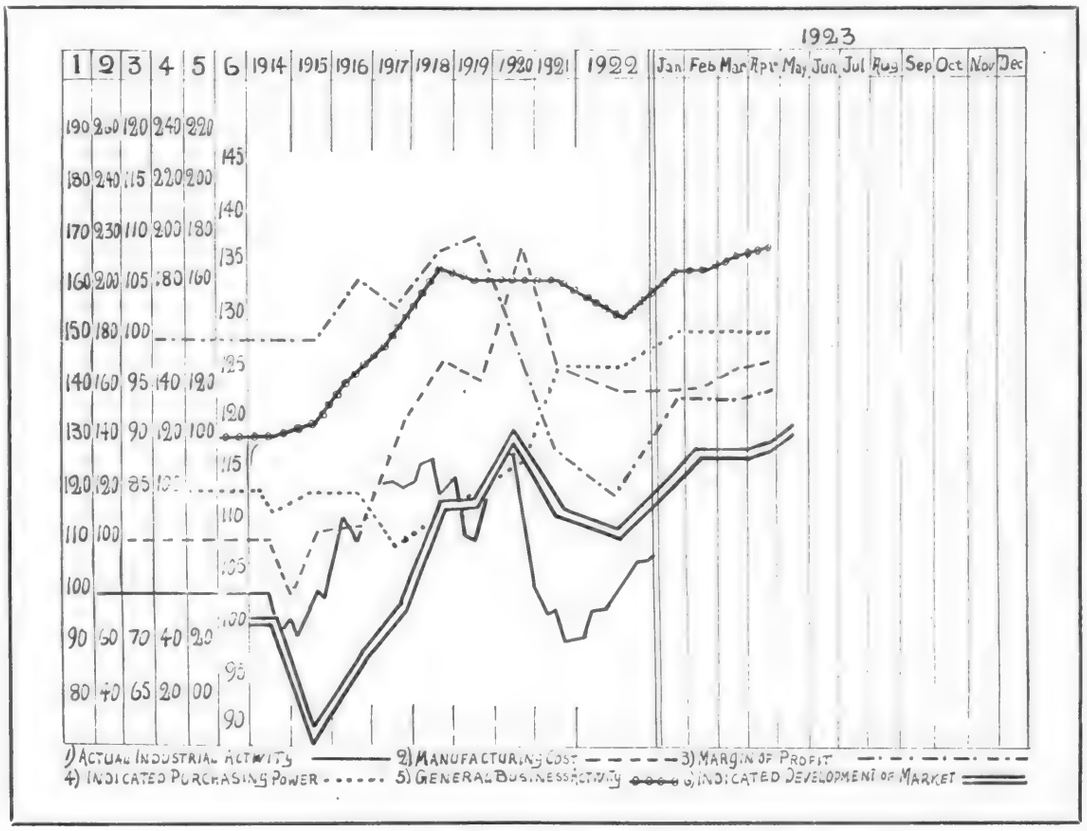
The Spring, long delayed, has arrived and in its wake has come the long-expected wave of popular buying. The wage-earner and the salaried man have realized that it is no use any more to hold back with purchases. As the result retail stores all over the country will be getting busy. This development is helped along by wage increases in many industries which, while they have, so far, not added to the actual purchasing power of the nation, nevertheless, have made the consumer more hopeful and, therefore, more inclined to spend the savings held up till now to protect against a recurrence of bad times.

Students of the labor situation remark upon the shortage of labor in many industrial centers, such as those of New England and similarly situated cities in the Middle West. Considerable labor movements will be required to correct this condition, and care in future will have to be taken, to prevent the withdrawal of skilled labor from the points of employment.

A flurry in commodity prices has caused anxiety among consumers. There are no indications, however, of a heavy upward movement of prices. True, wholesale prices of many industrial commodities have advanced. The increase, however, is not sufficiently large to cause hardship. Also manufacturing expenses are on the upgrade which can not cause surprise considering the additions to the cost of raw materials and labor. But while these two cost factors entering industrial production have expanded in this manner, manufacturers somehow have managed to improve their situation. The average margin of industrial profits is showing even a slight improvement, as compared with the last month.

This tendency to larger manufacturing economies is one of the most pleasing features of the situation. It will lead in time to a general reduction of manufacturing cost, so to bring this into a better relationship to the selling price of the product. The still existing but now only slight weakness in the earning power of our industrial plants will adjust itself automatically.

If there is one cause for anxiety it is the somewhat rapid change from a state of economic depression to that of comparative prosperity, indicated very strikingly by the double line of the above chart. Lightning business recoveries, with strong indications of "boom" conditions, are not exactly rare in our economic history, and bankers, manufacturers and merchants have learned to view them with concern whenever they appear. The wise man will not trust too much the heralds of great prosperity, but wait very long for the signs of steadiness, until the situation has declared itself more completely. He will not have to wait very long for the signs of steadiness. They will become clear with the news of the development of the national crops. The farmer's business must provide the real measure for the strength of the economic wave, on the first crest of which we are riding just now.


1923
1 2 3 4 5 6 1914 1915 1916 1917 1918 1919 1920 1921 1922
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1) Actual Industrial Activity
2) Manufacturing Cost
3) Margin of Profit
4) Indicated Purchasing Power
5) General Business Activity
6) Indicated Development of Market

ANALYSIS OF BUSINESS CONDITIONS AT END OF APPRIL.

Copyright, 1923, by L. W. Alwyn-Schmidt.

From a painting by ARTHUR KELLEY

Home of Roger W. Babson, Wellesley Hills, Mass.; Benjamin Proctor, Jr., Architect.
IDEAL TYPE A HEAT MACHINE and AMERICAN Radiators installed by Barber Co., Boston

© ARCO 1923

When Roger Babson invests in warmth

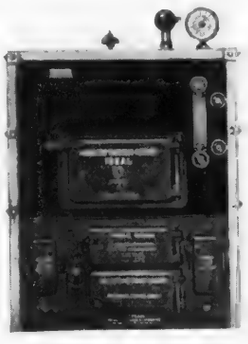
THOUSANDS of discerning investors have profited by Roger Babson's business reports and financial service.

Recently Mr. Babson made an investment on his own account, and these paragraphs are from his letter concerning it:

"The TYPE A BOILER installed in my residence is what you call it—a 'Heat Machine'," he writes. "During the coldest weather we attend to it only twice a day and at times it can be left sixteen hours without attention.

"My experience with the regular type of boiler in my old residence leads me to believe that the Type A is fully 20% more economical."

Mr. Babson often advises his clients to "take a loss" by selling a bad investment, and put the money into a security with assured earning power.



May we suggest that this same advice might well be given to clients who are more impressed with economy in the initial cost of their heating plant than economy in fuel consumption.

For the IDEAL TYPE A HEAT MACHINE is a lifetime investment. Its unique construction and automatic regulation assures a saving of from 20% to 33⅓% in fuel. In a few years the initial cost is paid back, and thereafter it continues to pay a dividend each year that can never be passed.

To every Architect and Heating Engineer who has not full specifications, sizes, performance and construction details of the IDEAL TYPE A in file, we offer a complete book describing them. Your name on your letterhead sent to either address below will bring it at once.

AMERICAN RADIATOR COMPANY

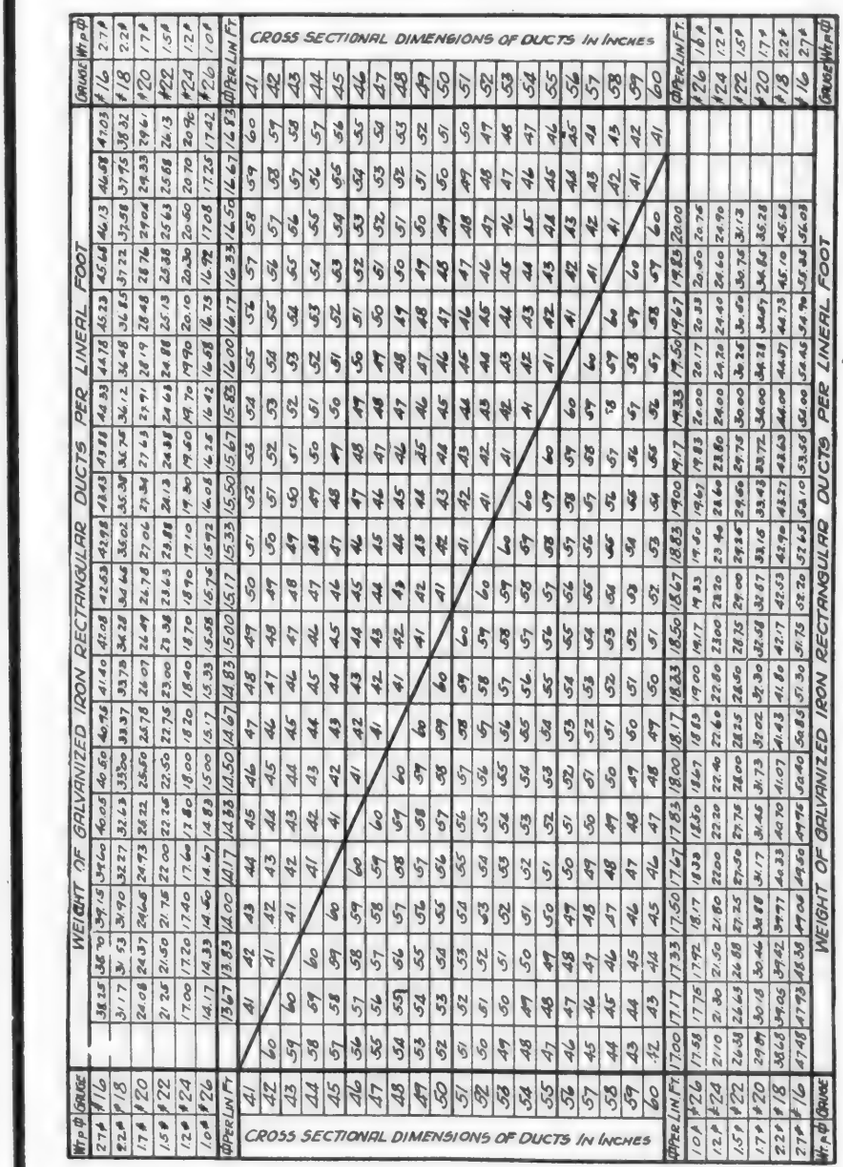
IDEAL Boilers and AMERICAN Radiators for every heating need

104 West 42nd Street, New York Dept. T-72 816 So. Michigan Ave., Chicago

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

TABLES FOR VENTILATING DUCTS.

Superficial Area and Weight of Galvanized Sheet Iron Rectangular Ducts.


WEIGHT OF GALVANIZED IRON RECTANGULAR DUCTS PER LINEAL FOOT
CROSS SECTIONAL DIMENSIONS OF DUCTS IN INCHES
Wt. & Gauge
@ Per Lin. Ft.

DUCTS AND FLUES—Area and Weight of Ducts. No. 11-J

Copies of this Data Sheet, printed separately. 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

HEAT EMITTED BY DIRECT RADIATION.

RESEARCH LABORATORY STANDARD DATA
AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
COPYRIGHT 1921

TABLE 1. HEAT EMITTED BY DIRECT RADIATION—SINGLE-COLUMN RADIATORS

Steam Temperature at 215 deg. fahr. *Room Temperature at 70 deg. fahr.*

No. of Sections	38 In.		32 In		26 In		23 In		20 In	
	Rated Surface sq. ft	Total B t u per hr	Rated Surface sq. ft.	Total B t u per hr	Rated Surface sq. ft	Total B t u per hr	Rated Surface sq. ft	Total B t u per hr	Rated Surface sq. ft	Total B t u per hr
1	3	1125	2.5	952	2	770	1.66	654	1.5	593
2	6	1849	5.0	1589	4	1293	3.33	1112	3.0	982
3	9	2578	7.5	2217	6	1807	5.00	1555	4.5	1377
4	12	3307	10.0	2845	8	2321	6.66	1997	6.0	1772
5	15	4035	12.5	3471	10	2835	8.33	2440	7.5	2168
6	18	4765	15.0	4098	12	3348	10.00	2882	9.0	2562
7	21	5494	17.5	4725	14	3863	11.66	3324	10.5	2957
8	24	6223	20.0	5354	16	4377	13.33	3767	12.0	3353
9	27	6950	22.5	5982	18	4891	15.00	4209	13.5	3748
10	30	7680	25.0	6610	20	5404	16.66	4652	15.0	4143
11	33	8408	27.5	7236	22	5918	18.33	5095	16.5	4538
12	36	9137	30.0	7863	24	6432	20.00	5538	18.0	4932
13	39	9867	32.5	8489	26	6947	21.66	5980	19.5	5327
14	42	10594	35.0	9117	28	7459	23.33	6422	21.0	5723
15	45	11322	37.5	9744	30	7974	25.00	6865	22.5	6118
16	48	12053	40.0	10372	32	8489	26.66	7309	24.0	6514
17	51	12781	42.5	10999	34	9000	28.33	7752	25.5	6908
18	54	13511	45.0	11624	36	9515	30.00	8193	27.0	7304
19	57	14239	47.5	12250	38	10028	31.66	8635	28.5	7698
20	60	14964	50.0	12875	40	10544	33.33	9080	30.0	8094

RADIATION COMPUTING—Heat Emitted by Direct Radiators, Single Col. | No. 13-M-M

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

HEAT EMITTED BY DIRECT RADIATION.

RESEARCH LABORATORY STANDARD DATA
AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
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TABLE 2. HEAT EMITTED BY DIRECT RADIATION—TWO-COLUMN RADIATORS

Steam Temperature at 215 deg. fahr. *Room Temperature at 70 deg. fahr.*

No. of Sections	45 In. Rated Surface sq. ft.	45 In. Total B.t.u. per hr.	38 In. Rated Surface sq. ft.	38 In. Total B.t.u. per hr.	32 In. Rated Surface sq. ft.	32 In. Total B.t.u. per hr.	26 In. Rated Surface sq. ft.	26 In. Total B.t.u. per hr.	23 In. Rated Surface sq. ft.	23 In. Total B.t.u. per hr.	20 In. Rated Surface sq. ft.	20 In. Total B.t.u. per hr.
1	5	1892	4	1586	3.33	1237	2.66	1100	2.33	967	2	823
2	10	2975	8	2475	6.66	2121	5.33	1736	4.66	1520	4	1313
3	15	4059	12	3373	10.00	2903	8.00	2373	7.00	2093	6	1810
4	20	5142	16	4272	13.33	3675	10.66	3010	9.33	2666	8	2304
5	25	6225	20	5172	16.66	4452	13.33	3652	11.66	3239	10	2798
6	30	7308	24	6072	20.00	5220	16.00	4289	14.00	3809	12	3292
7	35	8390	28	6972	23.33	5992	18.66	4920	16.33	4376	14	3786
8	40	9476	32	7869	26.66	6768	21.33	5560	18.66	4943	16	4279
9	45	10562	36	8766	30.00	7539	24.00	6197	21.00	5510	18	4772
10	50	11645	40	9668	33.33	8323	26.66	6832	23.33	6081	20	5264
11	55	12727	44	10567	36.66	9112	29.33	7471	25.66	6648	22	5753
12	60	13810	48	11467	40.00	9888	32.00	8109	28.00	7213	24	6245
13	65	14892	52	12367	43.33	10662	34.66	8746	30.33	7780	26	6738
14	70	15974	56	13266	46.66	11436	37.33	9383	32.66	8346	28	7232
15	75	17058	60	14164	50.00	12210	40.00	10020	35.00	8897	30	7728
16	80	18143	64	15062	53.33	12987	42.66	10662	37.33	9464	32	8221
17	85	19227	68	15960	56.66	13764	45.33	11299	39.66	10032	34	8714
18	90	20311	72	16859	60.00	14538	48.00	11933	42.00	10601	36	9209
19	95	21394	76	17758	63.33	15310	50.66	12570	44.33	11167	38	9703
20	100	22478	80	18656	66.66	16080	53.33	13211	46.66	11736	40	10196

RADIATION COMPUTING—Heat Emitted by Direct Radiators, Two Col. | No. 13-NN

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

HEAT EMITTED BY DIRECT RADIATION.

RESEARCH LABORATORY STANDARD DATA
AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
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TABLE 3. HEAT EMITTED BY DIRECT RADIATION—THREE-COLUMN RADIATORS

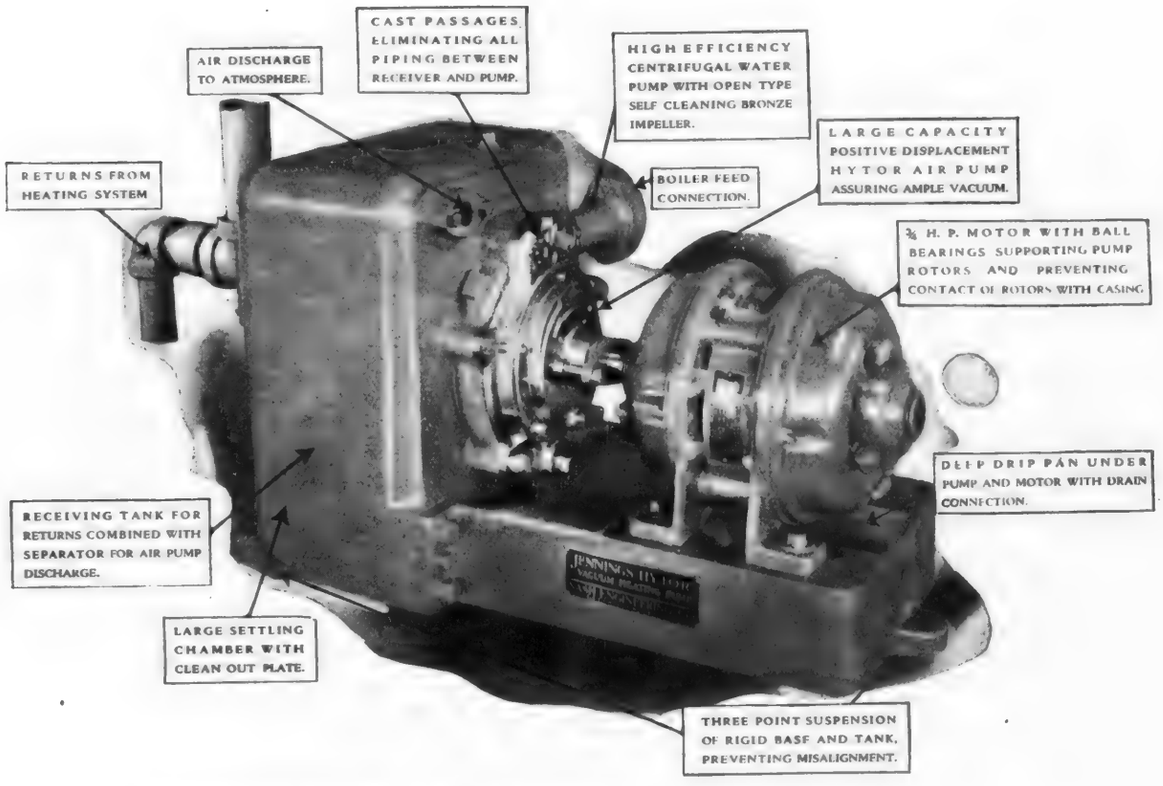
Steam Temperature at 215 deg fahr — *Room Temperature at 70 deg fahr*

No. of Sections	45 In		38 In		32 In		26 In		23 In		20 In	
	Rated Surface sq. ft	Total B t u per hr.	Rated Surface sq. ft.	Total B t u per hr	Rated Surface sq. ft.	Total B.t.u. per hr	Rated Surface sq. ft	Total B.t.u. per hr	Rated Surface sq. ft.	Total B t.u. per hr	Rated Surface sq. ft.	Total B.t.u. per hr.
1	6	2241	5	1898	4.5	1665	3.75	1372	3	1138	2.25	878
2	12	3480	10	2955	9.0	2635	7.50	2195	6	1816	4.50	1430
3	18	4720	15	4013	13.5	3605	11.25	3017	9	2496	6.75	1961
4	24	5959	20	5070	18.0	4674	15.00	3840	12	3174	9.00	2491
5	30	7197	25	6128	22.5	5544	18.75	4661	15	3854	11.25	3020
6	36	8435	30	7185	27.0	6512	22.50	5485	18	4532	13.50	3553
7	42	9677	35	8243	31.5	7481	26.25	6308	21	5211	15.75	4084
8	48	10915	40	9300	36.0	8453	30.00	7128	24	5890	18.00	4615
9	54	12155	45	10358	40.5	9420	33.75	7952	27	6569	20.25	5146
10	60	13392	50	11415	45.0	10391	37.50	8775	30	7248	22.50	5679
11	66	14632	55	12473	49.5	11360	41.25	9595	33	7927	24.75	6210
12	72	15872	60	13530	54.0	12328	45.00	10418	36	8608	27.00	6742
13	78	17113	65	14587	58.5	13297	48.75	11242	39	9286	29.25	7273
14	84	18354	70	15645	63.0	14270	52.50	12065	42	9962	31.50	7803
15	90	19593	75	16703	67.5	15242	56.25	12889	45	10643	33.75	8333
16	96	20832	80	17760	72.0	16207	60.00	13710	48	11323	36.00	8863
17	102	22068	85	18817	76.5	17174	63.75	14531	51	12000	38.25	9398
18	108	23306	90	19872	81.0	18144	67.50	15353	54	12679	40.50	9931
19	114	24544	95	20936	85.5	19118	71.25	16174	57	13361	42.75	10464
20	120	25776	100	21990	90.0	20088	75.00	16995	60	14040	45.00	10989

RADIATION COMPUTING—Heat Emitted by Direct Radiators, Three Col. No. 13-00

Copies of this Data Sheet, printed separately, 5 cents each.

If the User Were Designing a Vacuum Heating Pump He Would Have It—


CAST PASSAGES ELIMINATING ALL PIPING BETWEEN RECEIVER AND PUMP.
AIR DISCHARGE TO ATMOSPHERE.
HIGH EFFICIENCY CENTRIFUGAL WATER PUMP WITH OPEN TYPE SELF CLEANING BRONZE IMPELLER.
LARGE CAPACITY POSITIVE DISPLACEMENT HYTOR AIR PUMP ASSURING AMPLE VACUUM.
RETURNS FROM HEATING SYSTEM
BOILER FEED CONNECTION.
¾ H. P. MOTOR WITH BALL BEARINGS SUPPORTING PUMP ROTORS AND PREVENTING CONTACT OF ROTORS WITH CASING.
DEEP DRIP PAN UNDER PUMP AND MOTOR WITH DRAIN CONNECTION.
RECEIVING TANK FOR RETURNS COMBINED WITH SEPARATOR FOR AIR PUMP DISCHARGE.
LARGE SETTLING CHAMBER WITH CLEAN OUT PLATE.
THREE POINT SUSPENSION OF RIGID BASE AND TANK, PREVENTING MISALIGNMENT.

1. NOISELESS IN OPERATION
2. COMPACT IN DESIGN
3. POSITIVE IN ACTION
4. SIMPLE TO INSTALL
5. SIMPLE TO OPERATE
6. ATTRACTIVE IN APPEARANCE
7. ECONOMICAL

May

NASH ENGINEERING CO.
SOUTH NORWALK, CONN., U. S. A.

Please send graphic device, also bulletins covering

- ☐ **Return Line Heating Pumps**
- ☐ **Boiler Feed Pumps**
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The Jennings Return Line Heating Pumps have been conceived and produced with these ideals in mind, and the thousands already specified and installed are testimony of our success in meeting these requirements.

Our Engineering Department is at all times ready to render service on problems relating to heating.

The NASH ENGINEERING COMPANY

SOUTH NORWALK, CONN., U. S. A.

Trade and Miscellaneous Notes

Coming Events.

May 20-23, 1923.—Semi-annual meeting of the American Society of Heating and Ventilating Engineers, in Chicago. Headquarters at the Hotel Drake.

May 23-26, 1923.—Thirty-fourth annual convention of the Heating and Piping Contractors' National Association, in Chicago. Headquarters at the Hotel Drake.

May 28-31, 1923.—Spring meeting of the American Society of Mechanical Engineers, in Montreal, Canada.

June 4-6, 1923.—Thirty-fourth annual convention of the American Boiler Manufacturers' Association, in Hot Springs, Va.

June 20-23, 1923.—Fourteenth annual meeting of the National District Heating Association at Cedar Point, O.

June 25-30, 1923.—National Exposition of Building Ideas at new Public Auditorium, Cleveland, O.

June 26-28, 1923.—Forty-first annual convention of the National Association of Master Plumbers in Atlantic City, N. J. Headquarters at the Hotel Breakers.

September 10-13, 1923.—Eighteenth annual meeting of the American Society of Sanitary Engineers, in Davenport, Ia. Headquarters at the Hotel Blackhawk.

October 20-28, 1923.—Safety, Health and Sanitation Exhibition at 106th Infantry Armory, Brooklyn, N. Y.

Miscellaneous Notes.

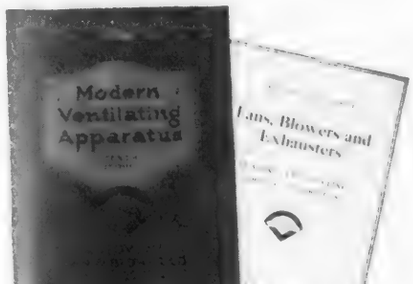
Denton, Texas.—Governor Neff has approved bills providing for expenditures of $300,000 for a new Administration Building at the North Texas Normal College and $110,000 for enlarging and improving the heating plant at the College of Industrial Arts.

Provo, Utah.—Fifty members of the Utah State Association of Sanitation and Heating attended a meeting here recently, when organization of the association was perfected and a constitution and by-laws adopted.

Columbus, Ohio.—Charges that House Bill 539 providing for a board of seven members with power to regulate the construction, alteration and repair of buildings was "slipped in" the Ohio Legislature have been made by the Allied Steam Heating and Ventilating Trades Association, which is opposed to the measure. C. N. O'Day, president of the association, declared the bill was "a most vicious piece of legislation and should be defeated."

Portland, Me.—A. M. Rosebrook, Portland representative of the Gurney Heater Manufacturing Co., of Boston, was elected president of the Plumbing, Steam and Metal Salesmen's association of Maine at the eighteenth annual meeting at Dunscroft Inn recently. Other officers for the new year were: R. C. Parker, The Smith & Abbott Co., Portland, first vice-president; Nathaniel M. Doten of Austen & Doten Co., Boston, second vice-president; Allen M. Pierce, Worthington Pump & Machinery Corp., Boston, third vice-president; Frank S. Billings, Austen & Doten Co., treasurer; J. Warren Chase of W. L. Blake & Co., Portland, financial secretary; and Eugene H. Winslow of Winslow & Co., Portland, recording secretary.

New York City.—The Heating and Piping Contractors' New York City Association has elected the following officers: John T. Dyas, president; George M. Scott, vice-president; William D. Emery, treasurer; and Henry B. Gompers, secretary. These officers,



"Modern Ventilating Apparatus"

would have to be described in a perpetual catalog. The Autovent Fan and Blower Company products being modern, they have issued a perpetual catalog that is an encyclopedia of ventilating information. Every modern engineer should have it and can get it by sending his name and address to the

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- Heating and Ventilating Data
- Determining Drive and Discharge Arrangements
- Pressure, Square Roots and Velocity Tables
- Properties of Dry Air
- Pressure Ins. Water to Overcome Friction Loss
- Area and Circumference of Circles
- Circular Equivalents of Rect. Ducts for Equal Friction

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Additional new pages to be published will be forwarded to the owners of these catalogs for insertion.

Autovent Fan & Blower Co.
DEPT. H.
730-736 W. Monroe St., Chicago, Ill.

REGISTERED AUTOVENT

together with Robert J. Currie and William J. Olvany form the new board of directors.

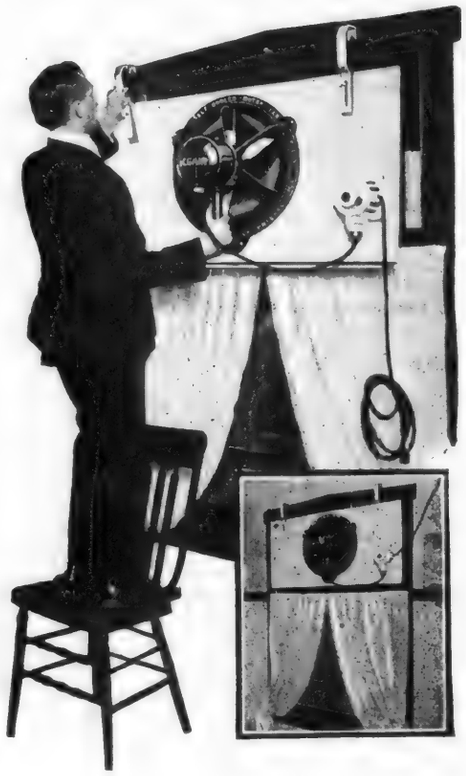
Heating and Piping Contractors' National Association.—Directors of the national association, at their recent meeting in New York approved the affiliation of two new local associations, the Heating and Piping Contractors' Cincinnati and Racine associations. A meeting of the Committee on Apprentices also was held recently at the national headquarters in New York.

Civic-Industrial Exposition.—A number of manufacturers in the heating and ventilating lines have arranged for exhibits at the Philadelphia Palace of Progress in the Commercial Museum in Philadelphia, May 14-26, 1923, including the Superbo Water Heater Co., Richardson & Baynton Co., Philadelphia Steam Heating Co., Abram Cox Stove Co., Mahlon H. Rickert, J. Howard Hutchison, and the Philadelphia Furnace & Supply Co. The exposition will celebrate the 240th anniversary of the founding of Philadelphia.

Carnegie Summer School.—Several courses of lectures and shop work in heating and ventilating are offered in the summer school of the Carnegie Institute of Technology at Pittsburgh, June 25 to August 17. These courses will be given by the Department of Heating and Ventilating in the College of Industries.

Residential Building Construction.—Contracts for residential construction awarded in March in 36 eastern States or about seven-eighths of the country's total construction volume, totaled $175,705,000, according to the F. W. Dodge Corporation. This is greater than in any previous month on record, while total construction contracts for all classes of buildings awarded during the month in these 36 states amounted to $371,447,000, an increase of 32% over February, and 14% over March, 1922 in 27 of the states covered.

Boston.—Ralph S. Franklin of the A. B. Franklin, Inc., was reelected president of the Heating and Piping Contractors' Boston association at the annual meeting held recently. Other officers elected were: P. J. McMurrer of The McMurrer Co., vice-president; W. T. Smallman of the Isaac Coffin



THE NEW PORTABLE ILGAIR VENTILATOR

HERE'S another Ilg development—the **Ilgair Portable Panel**—just the thing for homes, offices, stores, hotels, etc., where a permanent installation is not desirable.

It's the greatest idea for 1923. Fits any window—can be installed in a jiffy. No screws or nails required—simply hang it like a picture on the wall, then make connection with a nearby lamp socket, and the job is done.

MADE IN THREE SIZES TO TAKE CARE OF WINDOWS RANGING FROM 25" TO 48" WIDER IF NECESSARY AT ONE COST—NO EXTRAS

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HIGH EFFICIENCY ILG VENTILATING MACHINERY

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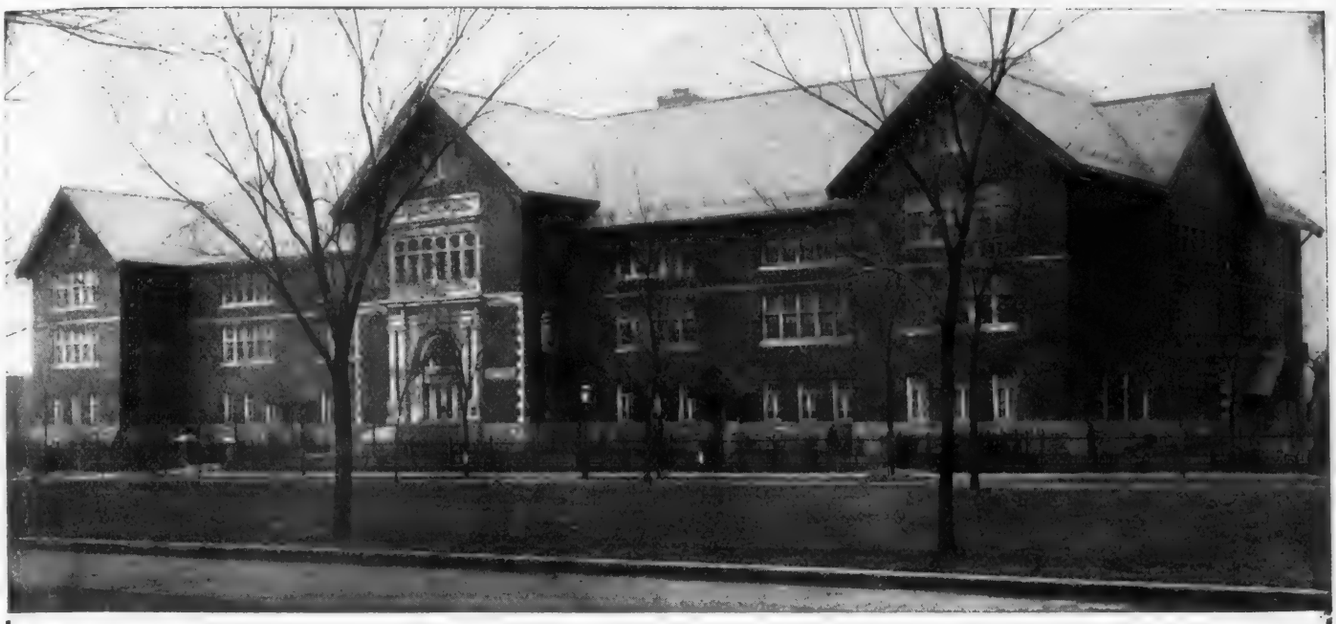
ILG ELECTRIC VENTILATING CO. 2858 NORTH CRAWFORD AVE. CHICAGO

BRANCHES IN ALL PRINCIPAL CITIES



E. S. Hallett, Engineer R. M. Milligan, Architect D. F. Edwards Heating Co., Htg. Contractors

WOODWARD SCHOOL, ST. LOUIS

Almost Complete Recirculation of Air

in school ventilating systems is most desirable. Saving in coal by recirculation is from 50 to 75%.

This is made possible by the use of

"Buffalo" Fans and Carrier Air Washers

for movement of air, elimination of odors and dust-borne bacteria.

Mr. E. S. Hallett, Chief Engineer, St. Louis Board of Education—states that in the new Woodward School shown above, 92% of the air has been recirculated through the heating season with a 75% reduction in coal compared with non-recirculation, and with perfect ventilation—less sick absences than any other school of the same size in the city.

Buffalo Conoidal Fans and Carrier Air Washers are used in this school.

We advocate the use of a system of air recirculation as most scientific and will be glad to refer architects and engineers to authorities in its support.

Buffalo Forge Company

Carrier Air Conditioning Company of America

480 Broadway Buffalo, N. Y.

Co., treasurer, and Charles W. Sisson (reelected), secretary. The directors chosen were: H. E. Barber, M. E. Chase, William H. Oakes, W. S. Cousens, F. A. Merrill and F. S. Claghorn.

Chicago.—Thousands of vistors were interested by exhibits presented by heating manufacturers at the Chicago "Own-Your-Home" exposition recently. An attractive booth was arranged by the Home Oil Heating Corporation while those of the Naster Heat Regulator and the Continental Oil Burner corporation also attracted comment. "Nokol," the sign of the Nokol oil burner and the domestic oil burner and water heater, products of the American Oil Burner and Boiler Co., was another center of interest during the exposition.

Eastern Trade Golf Association.—New officers were elected, reports of the 1922 tournaments read and plans made for 1923 at a recent meeting of the Eastern Trade Golf Association, in New York City. New officers selected were: President, J. Barnum; vice-president, E. F. Keating; secretary-treasurer, R. G. Bookhout; captain, J. B. Garfield; board of governors: B. W. Bennett, W. H. Staples, D. C. Chaddock, H. S. Maddock and O. E. Goldschmidt.

Detroit, Mich.—The twenty-ninth annual meeting and banquet of the Detroit Engineering Society was held at the Cadillac Hotel in Detroit, April 28, with an unusually large attendance. Speakers included Dean F. Paul Anderson, of the University of Kentucky; Mayor Frank E. Doremus, of Detroit, and President David Friday of the Michigan Agricultural College.

Caldwell, Idaho.—Plans for the construction of a new science hall and a gymnasium for the College of Idaho have been made public, disclosing that a feature of the gymnasium is to be construction of a central heating plant as an auxiliary part of the structure. The two buildings will cost approximately $140,000.

Columbus, O.—Allied Steam Heating and Ventilating Trades Association has been formed in Ohio, with headquarters in Columbus. Already, it is stated, more than 150 firms in the State have become members. The association will devote its efforts to developing the market for steam heating systems of all kinds. The organization is the result of the discussions carried on at weekly luncheons during the past year of a number of Columbus heating contractors. The officers are: President, Cortland N. O'Day, Colby Merrill Co.; vice-president, Edward L. Anderson, American Blower Company; secretary, Edward F. Marshment, heating contractor; trustees, Joseph W. Wuellner, Peter A. Fitzpatrick, A. W. Reynolds, Dennis J. McGonagle; all heating contractors, of Columbus, and Knute A. Nylan, heating engineer.

Manufacturers' Notes.

United States Radiator Corporation, Detroit, has let contracts for the construction of a two-story foundry addition to its plant, to cost, when equipped, about $100,000.

Walworth Manufacturing Co., B ton, officers and employees entertained Howard Coonley, president, at a dinner in honor of his tenth anniversary as head of the company recently. About 300 officers and employees attended the dinner.

C. P. Wadley, president of Excelso Specialty Works, Buffalo, N. Y., has returned from a tour of the Pacific coast, during which he combined business with pleasure, visiting San Francisco, Los Angeles, Portland, Ore., and other cities.

Union Radiator Co., Johnstown, Pa., has moved its Pittsburgh branch to 207 Fulton building. Frank A. Vance has charge of the Pittsburgh branch.

B. F. Sturtevant Co., Boston, Mass., has purchased the plant of the Wisconsin Engine Co., at Corliss, Wis., for approximately $100,000 and will refit it for the manufacture of heating apparatus.

American Radiator Co., Chicago, has purchased two blast furnaces at North Tonawanda, N. Y., from the Donner Steel Co., and will produce its own pig iron. The operation of these furnaces, which have been idle since 1919, will be resumed at an early date.

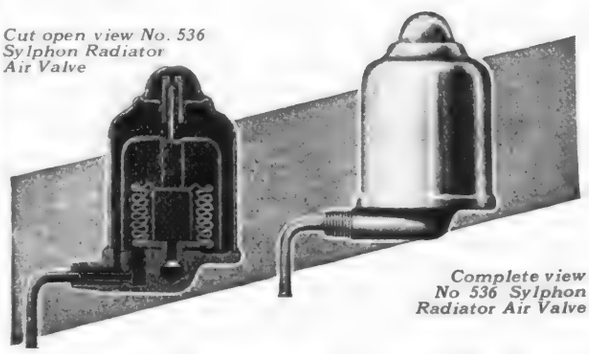
Scott Valve Co., Chicago, announces the election of E. W. Thomas as president and treasurer, to succeed C. W. Thomas, who died recently. Other officers elected are: F. P. Thomas, vice-

Sylphon TRADE MARK

Radiator Air Valves Positively and Unfailingly Vent All Air

There are two, and only two, vital elements in any air valve—the float and the thermostatic element. If the float is large enough and the thermostatic element powerful enough, the valve will give satisfactory service.

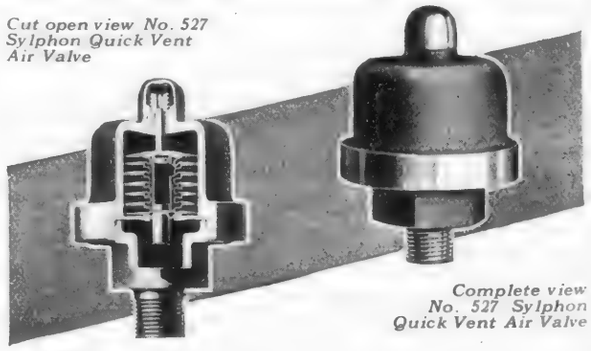
Cut open view No. 536 Sylphon Radiator Air Valve



Complete view No 536 Sylphon Radiator Air Valve

In No. 536 Sylphon Radiator Air Valve the float is 1¾ inches in diameter, giving greater buoyancy than any other air valve on the market. Positively closes against water. The Sylphon bellows is 1⅛ inches in diameter, giving ample power and movement. Positively closes against steam. A small bent pipe serves to drain the valve should water collect.

Cut open view No. 527 Sylphon Quick Vent Air Valve



Complete view No. 527 Sylphon Quick Vent Air Valve

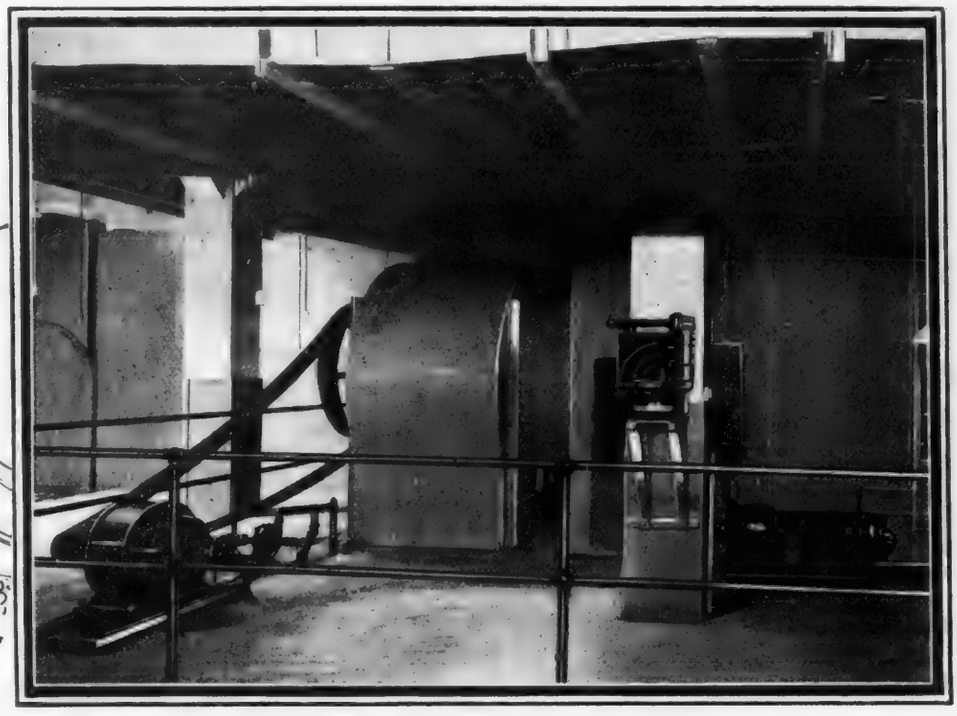
No. 527 Sylphon Quick Vent Air Valve is for use on steam mains and risers, in conjunction with No. 536. Its function is to vent the larger amount of air in these distributing pipes, and take off the radiator valves a large portion of the work of venting. In construction, No. 527 is the same in principle as No. 536, except that it has no float, because being installed above the water line it does not need to stop water. Venting orifice is 3/32 of an inch in diameter. Improves all low pressure steam jobs. Prevents dead end pockets. Should be installed on the pipe lines of every well designed direct steam system.

Send for Air Valve Folder WAV

THE FULTON COMPANY, Knoxville, Tennessee

Representatives in Principal Cities New York Chicago Detroit

Installation of American Blower equipment in American Exchange National Bank Bldg., Dallas, Texas



Industrial Efficiency and Washed Air

Wholesome, washed air, giving indoors the conditions of clean invigorating, out-of-door air, is being demanded more and more in modern industrial plants.

The important factors of air quality—proper temperature and humidity, air movement and freedom from dust and bacteria—can be controlled only by the use of air washers in conjunction with a heating and ventilating system.

American Blower Air Washers have many features that cause them to be preferred by leading architects and engineers. The spray nozzles have an extremely high cleansing and cooling efficiency. They may be automatically flushed by simply turning a valve. The design, materials and application are selected with the judgment of long experience, insuring durability and proper functioning.

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO
(271)

American Blower

"Sirocco" TRADE MARK

EXHAUSTERS · VENTILATING FANS · AIR WASHERS · BLOWERS · ENGINES
FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

president, and A. P. Gow, secretary and manager.

Cleveland Gas Burner & Appliance Co., Cleveland, O., has established a new department to manufacture iron and brass parts and special fittings for the heater trade.

Uehling Instrument Co., Paterson, N. J., has effected an agreement with the Combustion Engineering Corporation, Ltd., whereby the latter company will handle its products in Canada.

Donnelly Systems Company, New York, announces the appointment of Webster Tallmadge to have charge of the company's sales and service departments. Mr. Tallmadge was for a number of years connected with the Westinghouse Company and recently held the position of technical manager with the Vacuum Oil Company.

Harry Booth, newly appointed manager of the New York office of the United States Radiator Corporation, was the guest of honor at a dinner tendered him recently by friends in the trade in Chicago where he had been manager of the corporation's office for a number of years. One of the features at the dinner was presentation to Mr. Booth of a silver dinner set by a group of friends in the Western Trade Golf association of which he also was an active member. Mr. Booth succeeds Albert H. Ross, who died recently.

Central Station Heating Notes.

Big Rapids, Mich.—Several local manufacturers are planning the construction of a central heating plant to supply heat to the Falcon Manufacturing Co., Hanchett Swage Works and the Big Rapids Furniture Co. Estimates on the cost of such a plan are being obtained and the plant may be erected this summer.

Virginia, Minn.—The city council has appropriated $300,000 to be expended in improving and enlarging the municipal central heating plant. All of the city's buildings and a number of commercial houses are heated by the plant and plans are under way to connect the new $400,000 City Hall and Recreation building soon to be constructed.

Astoria, Ore.—A franchise for the construction and operation of a central heating plant has been granted by the city to the Consumers Central Heating Co., of Tacoma, and preliminary surveys are under way. Tentative plans call for the expenditure of $100,000 on the plant which would supply heat to new buildings to be erected in the burned area of the business district.

Chippewa Falls, Wis.—The city has just completed construction of a new $28,000 central heating station to supply heat to the City Building, new Junior High School, the public library and the new Island Street School. The plant operates on the vacuum system, with provision, however, for converting it to a gravity system if occasion demands.

Vancouver, Wash.—The Vancouver Steam & Manufacturing Co., which took over the plant of the Columbia Dairy Products Co., and converted it into a central heating station with provision for the manufacture of ice and storage space, is now supplying heat to sixteen business houses. The plant has a capacity of 30,000 sq. ft. of radiation.

Contracts Awarded.

Stockton, Calif.—Bids were received as follows for the heating and ventilating of the new Municipal auditorium: Brandt Bros., $65,379 and $64,079; Stockton Plumbing & Supply Co., $52,177 and $50,331; J. H. Pecard, Oakland, $50,642; E. P. Sexton, Stockton, $61,666; and Scott Co., Oakland, $62,860.

F. J. Donnelly, San Francisco, heating and ventilating the new high school in Santa Barbara, Calif., for $50,996; cast-iron boilers, $650 extra; additional oil burning equipment, $2,760.

Sweeney & Sons, Santa Barbara, Calif., direct heating system for the Santa Barbara high school for $50,740.

Freyn Bros., Indianapolis, Ind., heating and ventilating the new high ing and ventilating new grade school at Greengfield, O., for $37,277.

R. Raitz & Co., Toledo, O., heating and ventilating Franklin school in Toledo for $33,000 and plumbing $20,400.

Paul E. Mueller Co., Milwaukee,

PUBLIC SCHOOL No. 62, BRONX, New York City, N. Y.
Over one Hundred Lehigh Fans are installed in New York City Schools

LEHIGH MULTIBLADE FANS

FOR HEATING AND VENTILATING

WHERE large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior, to any other fans on the market.

HERSH BROTHERS CO.

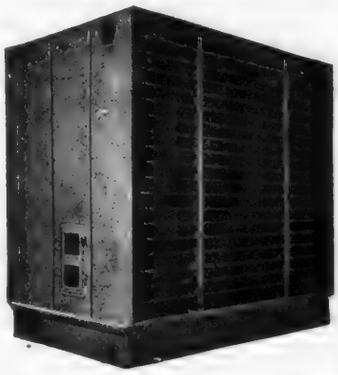
654 Mill Street **ALLENTOWN, PA.**

Peerless Ventilator

BUILT RIGHT RUN RIGHT

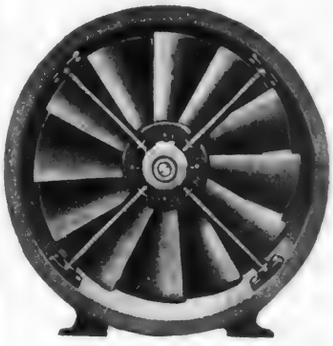
The New York Blower Co.

Chicago, Ill. La Porte, Ind.



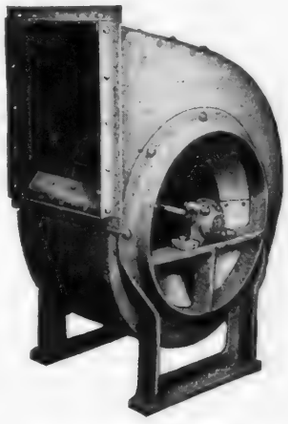
Peerless Air Washer

We manufacture a complete line of fan equipment and appurtenances. By concentrating on this one class of products we are able to make them better every year.



Pulley Driven Disc Fan for Mines

The old fallacy that fan equipment was a luxury is now known to be untrue; it is an economical necessity. We can give actual installations in all kinds of industries where through the wise employment of fan equipment manufacturers have improved the quality of their product, and increased production with a reduction in factory cost.



Type "C" Seri-Vane Fan

If you are interested in drying, humidifying, heating, ventilating, mechanical draft, removal of shavings or similar installations, please communicate with us. If we cannot honestly prove facts to you showing the benefits that will follow from an installation for your special problem, we will frankly so state.

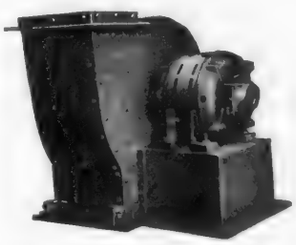
Motor Driven Propeller Fan

Slow Speed Planing Mill Exhauster

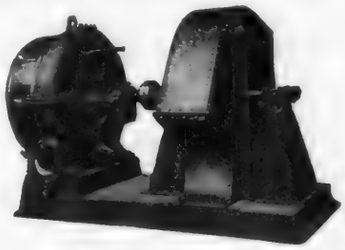
The New York Blower Co.

Chicago, Ill. La Porte, Ind.

Branch Offices in Principal Cities



High Speed Type "C" Seri-Vane Fan



High Pressure Blower Direct Connected to Turbine

Stoker Fan

Wis., heating the new community high school in Crystal Lake, Ill., for $26,095. The plumbing contract was awarded to Arthur W. Murray Co., Hoopeston, Ill., for $11,822.

Arthur W. Smith, Fremont, O., heating the new addition to the high school in Fremont, O., for $20,524. Mr. Smith also was awarded the plumbing contract for $10,141.

Pierson & Pierson, Fairfield, Ia., heating and plumbing for the new addition to the high school and for the new grade school, in Fairfield, Ia., for $25,381.56.

New Incorporations.

Suburban Heating Co., 6740 Windsor Avenue, Berwyn, Ill., capital $20,000, to manufacture and deal in furnaces, stoves, heaters, power plants, etc. Incorporators: N. S. Mitchell, L. E. McGuire, and Sidney Frisch. Correspondent, Morris Firsch, 6 North Clark St., Chicago.

Cenco Manufacturing Co., 18 W. Kinzie St., Chicago, capital $2,500, to manufacture and deal in heating plants. Incorporators: Lester E. Lee, Frank M. Kaufman and T. S. Johnson. Correspondent, Cleland, Lee and Phelps, 155 N. Clark St., Chicago.

Addison Heat Engineering Co., 3613 N. Ashland Ave., Chicago, capital $5,000, to install steam, water, vapor and vacuum heating and ventilating plants. Incorporators: Otto Baer, John A. Fensterle and Walter H. Friehage. Correspondent, Otto Baer, 127 N. Dearborn St., Chicago.

High Point Plumbing & Heating Co., High Point, N. C., capital $50,000. Incorporators: W. G. Cranford, P. E. Swain and J. A. Stith, all of Winston-Salem, N. C.

Republic Plumbing Supply Corporation, 102-104 Twenty-first St., Brooklyn, N. Y., capital $50,000, to conduct a heating and plumbing supply business. Richard M. Smythe is president of the new company.

Yelton-Weaver Supply Co., Springfield, Ill., capital $50,000, to act as jobbers in plumbing, heating, mine and factory supplies. Principal stockholders, H. C. Yelton and W. W. Weaver.

Chausse Oil Burner Co., 206 Lincoln Building, Detroit, Mich., capital $100,000, to manufacture house furnace burners, hand torches and oil-burning apparatus for asphalt street repairing. Officers: W. McK. White, president, W. G. Chausse, vice-president and Wrap P. White, secretary.

New Firms.

Engineering Service Co., 1812½ Main St., Waco, Texas, has been organized to design and install heating and ventilating work and to furnish consulting service in these lines. The head of the company is G. E. Gillespie. Mr. Gillespie was the engineer in charge of the heating and ventilating systems of the new Boren & Stewart Grocery Company warehouse and offices.

State Heating & Power Co., Inc., 272 Walnut St., Memphis, Tenn., has been organized to contract for the construction of power plants and the installation of ventilating systems, industrial piping, steam, water and vapor heating systems. The officers are: President, W. Harwell Allen; vice-president, Lawrence S. Akers, and secretary-treasurer, D. T. Gildart.

Charles T. Phillips Co., Los Angeles, Cal., is the title of a new engineering firm which has recently opened offices in the Wesley Roberts Building, Los Angeles. The company will specialize as heating, ventilating and electrical engineers. The personnel of the firm is made up of Charles T. Phillips, consulting engineer, of San Francisco; Arthur Kempston, recently engineer with the Pacific Fire Extinguisher Co., Los Angeles; and Fred B. McNally, mechanical engineer, Fresno, Cal. Catalogues from firms manufacturing heating and ventilating apparatus are desired.

Paul R. Postlewaite Co., Clinton Building, Columbus, O., has been organized to conduct a heating, ventilating and plumbing contracting business. Mr. Postlewaite, the head of the company, has been engaged in these branches for the past 20 years.

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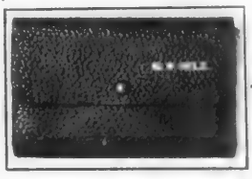

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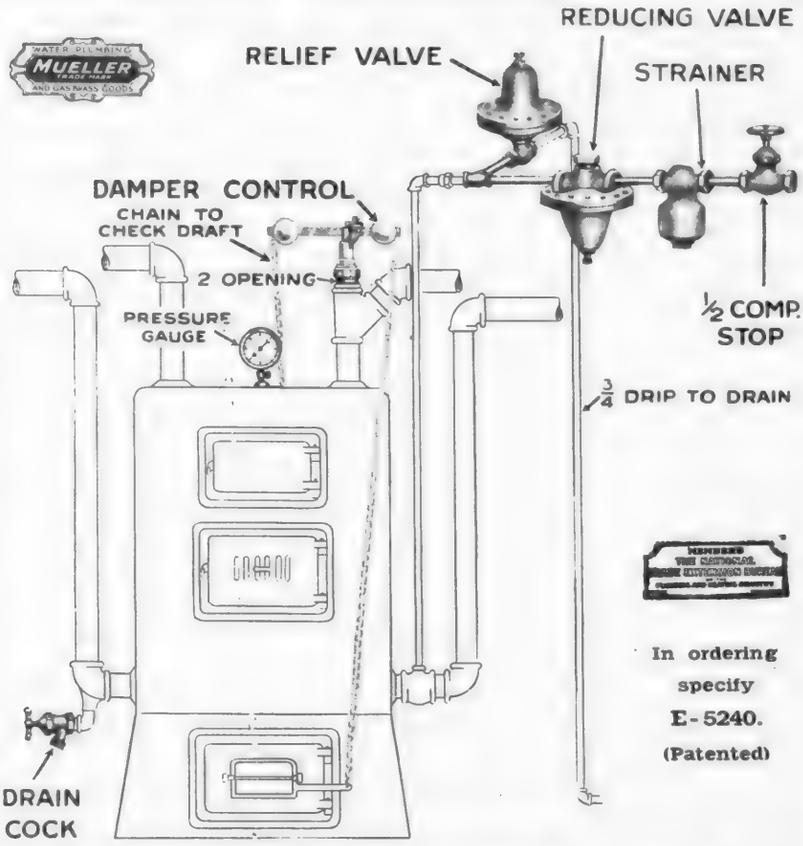

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Varying Opinions on Secretary Hoover's Recommendation to Hold Up Public Building Program.

Wide difference of opinion is expressed by business men an public officials throughout the country on the recommendation to President Harding by Secretary of Commerce Hoover that all but essential government work, national and local, be held in abeyance until general business construction has slackened.

Some strongly commend the position taken by Mr. Hoover as presenting a wise solution of what they fear is rapidly becoming a "runaway market." Others are equally strong in condemning any plan which would delay temporarily public construction.

The *Manufacturers Record*, of Baltimore, Md., has taken a strong stand against Mr. Hoover's plan, arguing that such a plan is "not the way to bring about long-continued prosperity but, on the contrary, is the way to bring about short-lived activity, with a long period of dullness and poverty following.

"If the power of the government or of the banking interests," it states in a recent issue, "is to be used at times to halt prosperity and building activities, merely because prices of materials and wages are regarded by officials as too high, then we will have fallen under the domination of a paternalism greater than this or any other country has ever known."

In recommending to the President that the government hold in abeyance all except absolutely essential construction work, Secretary Hoover stated that he had concluded, after a survey of the situation "that, at least for the next several months, the trades will be fully occupied in private construction, all of which is generally needed by the country.

"For the government to enter into competition at the present moment," he continued, "will give no additional employment to labor and no additional production of materials but must in the broad sense in the end displace that much private construction. The governments, nationally and locally, are in a much better position to hold construction work in abeyance than are private concerns, and are in better position to speed up in times of less demand as we did in the last depression as the result of the Unemployment Conference.

"I would recommend, therefore, that you (President Harding) direct the different divisions of the Government to initiate no new work that is not eminently necessary to carry on the immediate function of the Government and that there should be a slowing down of work in progress so much as comports with real economy in construction, until after there is a relaxation in private demands."

"It seems obvious that the best welfare of the country is served by reasonable stability of prices," H. C. Blake of the Foos Gas Engine Co., Springfield, O., states in indorsing Mr. Hoover's recommendation "and is injured by a condition which shifts them up or down rapidly."

W. S. Hays, secretary of the National Slate Association with headquarters in Philadelphia, takes the position that Mr. Hoover's recommendation is a timely warning to the "unscrupulous material and labor interests" and that delaying government work constitutes a "constructive policy."

Chamber of Commerce of U. S. on Trade Associations.

Voting on eight separate propositions, a majority of the business organizations affiliated with the Chamber of Commerce of the United States voiced approval of the existence of trade associations in each important branch of industry in a referendum canvass recently conducted by the chamber.

The referendum covered the entire field of activity of trade associations and showed unmistakable sentiment in favor of properly functioning organizations which would be prepared to consider all problems affecting each particular industry or branch of business.

Important propositions submitted to a vote included the following: That trade associations should be free from special forms of governmental control; that statistics of capacity, production, stocks and sales should be collected; and that interpretation of statistics or other comment which could induce or facilitate concerted action on the part of members should be omitted by a trade association.

The committee which drew up the propositions recommended that all statistics regarding prices should be confined to closed transactions and should not refer to pending transactions or future transactions.

Wage Scales in the Building Trades.

Twenty-eight wage raises and only two wage cuts constitute the record for the past ten months in the building trades, ending February, 1923. The rates now prevailing (February 28, 1923) for steam fitters and plumbers, as compiled by the *American Contractor*, are as follows:

(Where two figures are shown they are the minimum and maximum wages paid.)

	Plumbers	Steam Fitters
Akron, Ohio	.75 .85 .70	.75 .85 .70
Atlanta, Ga.	1.00	1.00
Baltimore, Md.	.93¾	.90
Binghamton, N. Y.	1.00	1.00
Boston, Mass.	1.00	1.00
Buffalo, N. Y.	1.00	1.00
Chicago, Ill.	.95	.95
Cincinnati, Ohio	1.00	1.00
Cleveland, Ohio	1.10	1.10
Columbia, S. C.	1.12½	1.12½
Columbus, Ohio	1.00	1.00
Dayton, Ohio	1.00	1.00
Des Moines, Iowa	1.00	1.00
Detroit, Mich.	1.00	1.00
Dubuque, Iowa	1.00	1.00
Duluth, Minn.	.80	.80
Erie, Pa.	1.00	.80
Fitchburg, Mass.	....	....
Grand Rapids, Mich.	.90	.90
Greensboro, N. C.	1.00	1.00
Hamilton, Ohio	1.00	1.00
Indianapolis, Ind.	1.12½	1.12½
Johnstown, Pa.	1.00	.85
Lima, Ohio	.85	.85
Little Rock, Ark.	1.12½	1.12½
Los Ageles, Cal. (rate per day)	9.00	8.00
Louisville, Ky.	1.25	1.06¼
Memphis, Tenn.	1.17½	1.17½
Milwaukee, Wis.	1.00	.90
Minneapolis, Minn.	.87½	.80

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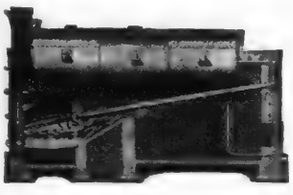

Designed and manufactured for any make of Water Tube, Scotch Marine or Return Tubular Boilers, for high or low pressure they can be attached to old or new boilers, by any Steam Fitter or Boiler Maker, from information given on Drawings furnished by us.

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That's where it stays, instead of being carried forward with the air.—MIDWEST FILTERS are conceded to be the best type of filter for satisfactorily solving dirt and dust problems.

The air is cleaned without washing. No water sprays or pumps are used. For ventilation work—such as schools, banks, office buildings, specify MIDWEST.—It provides simplicity of operation, no skilled help required, and all units or cells are inter-changeable.

Each cell can be lifted from the frame when dirty and replaced with a spare clean cell by one man without a shutdown. The dirty cells can be washed and recoated by a simple dipping process.

The entire filter is extremely compact, easily installed and has no moving parts. Upkeep costs are practically nothing. Very flexible, as it can be increased in capacity or reduced and installed to assume regular or irregular shape.

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	1.00	1.00
Nashville, Tenn.	1.12½	1.12½
	....	....
New Haven, Conn.	.87½	.87½
	....	....
New York City	1.12½	1.12½
	....	....
Norfolk, Va.	1.00	1.00
	....	....
Oklahoma City, Okla.	....	....
Omaha, Nebr.	1.00	1.00
	.90	.90
Philadelphia, Pa.	1.00	1.00
	....	....
Pittsburgh, Pa.	1.15⅝	1.25
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Portland, Me.	.90	.90
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Reading, Pa.	1.00	1.00
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Redfield, So. Dak.	.90	.90
	....	....
Richmond, Ind.	.80	....
	.75	....
Richmond, Va.	.87½	.87½
	....	....
Rochester, N. Y.	.93½	.93½
	....	....
Saginaw, Mich.	1.00	1.00
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San Francisco, Cal.	1.12½	1.12½
	....	....
Savannah, Ga.	.90	1.00
	....	....
Sharon, Pa.	1.00	....
	....	....
Sioux City, Iowa	1.00	1.00
	1.12½	1.12½
Shreveport, La.	1.25	1.25
	....	....
St. Joseph, Mo.	1.12½	1.12½
	....	....
St. Louis, Mo.	1.25	1.25
	....	....
St. Paul, Minn.	.80	.80
		1.00
St. Petersburg, Fla.	1.00	hr.
		.75
Toledo, Ohio	1.00	1.00
	....	....
Tucson, Ariz. (rate per day)	8.00	8.00
	....	....
Washington, D. C.	1.06¼	1.06¼
	....	....
Webster City, Iowa	.75	.75
	....	....
Youngstown, O.	1.00	1.00

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

HEATING AND VENTILATING

FORGE SHOPS. Forge Shop Heating and Ventilating, O. H. Bathgate. Forging and Heat Treating, vol. 9, No. 1, Jan. 1923, pp. 31-37, 8 Figs. Problems encountered in heating and ventilating industrial buildings; comparison of natural and artificial ventilation; dust collecting systems.—50¢.

MANOMETERS

VENTILATING MEASUREMENTS. A Precise Manometer for Ventilation Measurements, Walter S. Weeks. Min. and Metallurgy, vol. 4, No. 193, Jan. 1923, pp. 19-22, 8 Figs. Details and operating of manometer developed by author. —50¢.

OIL FUELS

BURNING, EFFICIENT. The Practical Use of Oil Fuels, Allen F. Brewer. Combustion, vol. 8, No. 2, Feb. 1922, pp. 94-97 and 104. Characteristics of oil fuel.—50¢

COMBUSTION. Judging the Combustion of Liquid Fuels, A. G. Witting. Blast Furnace and Steel Plant, vol. 11, No. 1, Jan. 1923, pp. 125-127. Formula for calculating results of combustion from waste-gas analysis applied to liquid fuels; by-product tar used as typical example; moisture calculation not essential.—50¢.

VENTILATION

MOULDING SHOP. Ventilating a Moulding Shop, James Mackay. Domestic Eng., vol. 101, No. 6, Nov. 11, 1922, pp. 227-229, 3 Figs. Ventilating and air-conditioning apparatus furnishing 6,000,000 cu. ft. of air per hr., installed in iron-foundry moulding shop.—30¢.

SALESMEN WANTED.— Experienced heating salesmen to call on heating trade are wanted by a nationally-know manufacturer of boilers and radiators. State experience, present employment, age, references and probable location. Address Box 104, care of Heating and Ventilating Magazine.

FOR SALE.—One Bignall & Keeler pipe-cutting and threading machine, 2½ in. to 6 in. capacity. One ditto ⅛-in. to 2-in. capacity. Both belt driven and in good condition. Also one Sprague electric ½-ton hoist with D. C. motor 500 volts, never uncrated. Bargain price. Edward Joy Co., Syracuse, N. Y.

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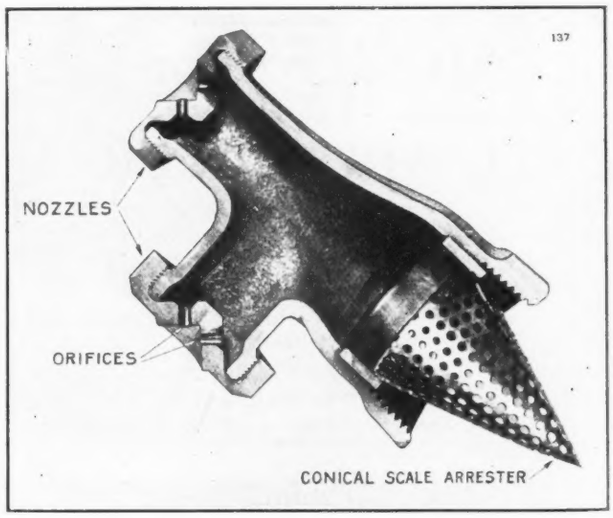

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The cut indicates a longitudinal section through a spray head, showing the two impact nozzles with their smooth, round orifices, entirely devoid of obstructing vanes or spiral passages. The conical scale arrester, with its numerous holes, each smaller than the nozzle orifice, intercepts and retains all dirt and scale large enough to plug the nozzles. During this slow accumulation the nozzles spray at full capacity.

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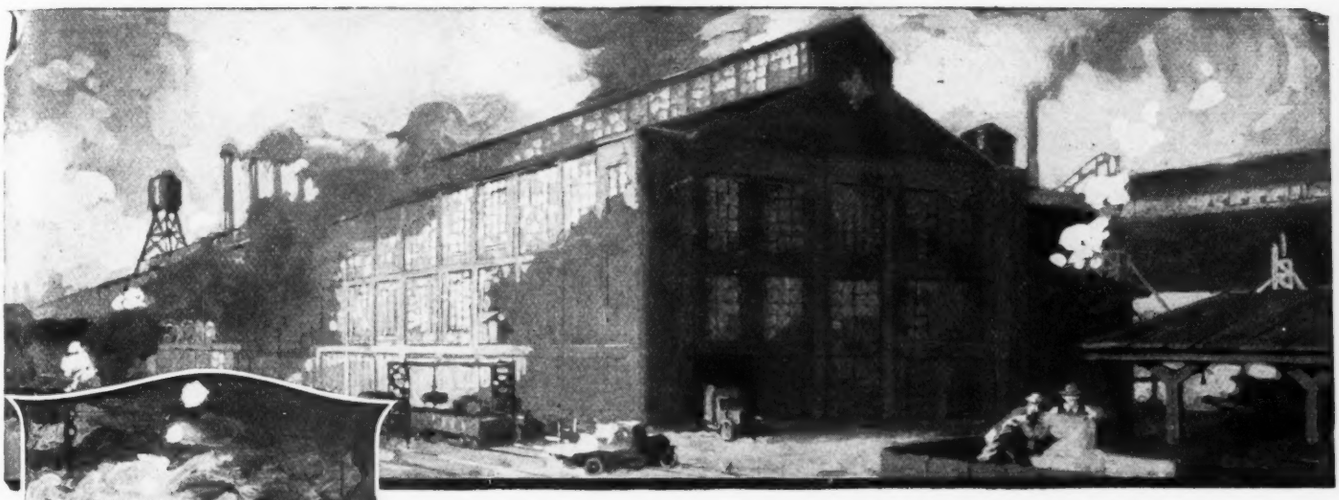

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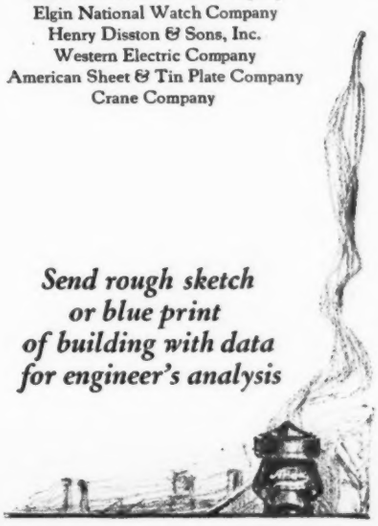
Send rough sketch or blue print of building with data for engineer's analysis



Arex Ventilation Engineering Survey SPECIFICATION BLANK

We desire to receive *Gratis* an engineer's analysis of the following building: ..... *State character of work or business building is used for*

We are troubled with: Fumes ☐ Smoke ☐ Foul Air ☐ Heat ☐ Condensation ☐ Steam ☐

Dimensions of Building: Width .....Ft. Length .....Ft. Ceiling Height .....Ft.

Construction of Building: State whether Brick ☐ Concrete ☐ Frame ☐ Stucco ☐

Type of Roof: State whether Flat ☐ Slant ☐ Gable ☐ Sawtooth ☐ Monitor ☐

Pitch of Roof ..... State how many ..... inches to the foot .....

Location of Floor or Room to be ventilated .....

How high do adjoining Buildings extend over your Roof? .....

How many feet distant are the surrounding Buildings, or is your Building entirely unsurrounded? .....

....
Firm Name Name of Individual Title of Individual

....
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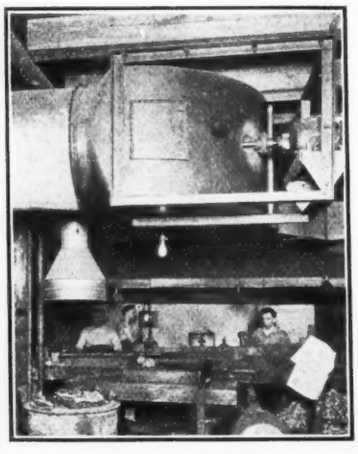

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The Unique, Compact Design of

THE WING-SCRUPLEX EXHAUSTER

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Simplifies Localized Ventilation

A localized ventilating system with a *Wing-Scruplex Exhauster* is the most efficient method of keeping the air in your plant fresh and pure. It exhausts the heat, smoke, steam, grease, vapors, fumes, etc, *directly* from the machines, vats, or processes, etc. These elements are carried off from their point of origin before they have a chance to spread throughout the premises.

We would like to explain how the *Wing-Scruplex Exhauster* is doing this in many varied ways for hundreds of satisfied users.

Write for complete information on this modern Exhauster

MOTOR ENTIRELY OUTSIDE THE CURRENT OF VAPOR OR AIR HANDLED BY THE FAN — KEEPS CLEAN AND COOL
BEARING IS FLOODED CONSTANTLY WITH FRESH CLEAN AIR - AIR HANDLED DOES NOT COME IN CONTACT WITH BEARING
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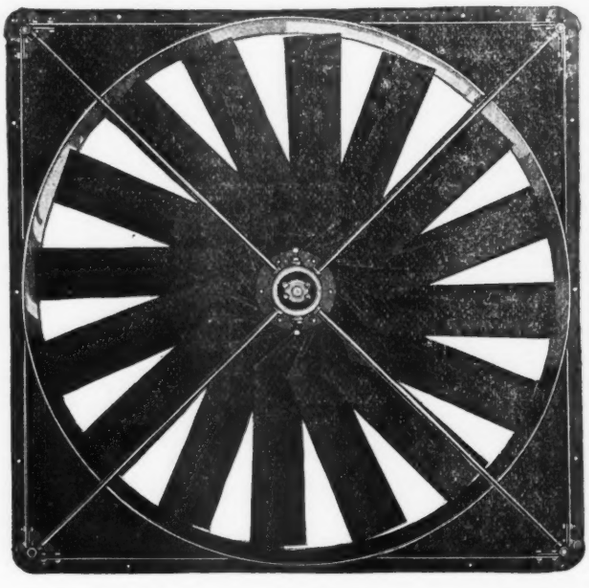

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HAND STOKER
"It Burns the Smoke"

The Twin-Fire Hand Stoker is adaptable to boilers in office and factory buildings and large apartments. It increases boiler power, decreases fuel consumption and eliminates smoke. Above all it is dependable.

Write for our book "More Boiler Power With Less Coal." Also our simple analysis sheet if you want us to make a report on your coal consumption. Learn more about the efficient Twin-Fire Hand Stoker today. There's no obligation on your part and the information may prove valuable.

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